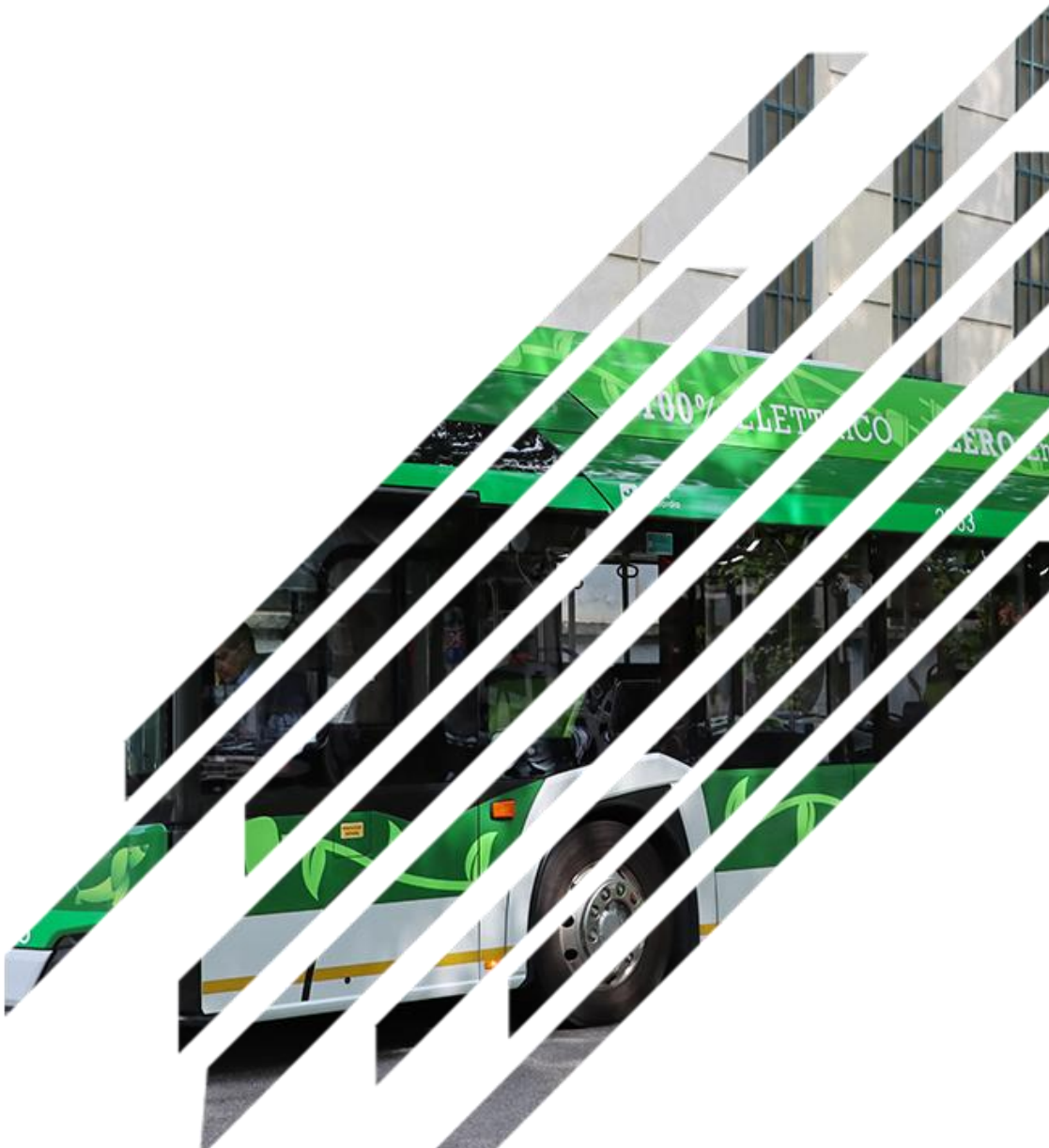
SPINE
Smart Public transport Initiatives for climate-Neutral cities in Europe

Smart Public transport Initiatives for climate
Neutral cities in Europe

D2.5 BOLOGNA LL and Implementation Version 1



Document Summary Information

Grant Agreement No	101096664	Acronym	SPINE

Full Title	Smart Public transport Initiatives for climate Neutral cities in Europe		
Start Date	01/01/2023	Duration	48 months
Project URL	https://www.spine-project.eu/		
Deliverable	D2.5 BOLOGNA LL and Implementation Version 1		
Work Package	WP2		
Contractual due date	30 June 2024	Actual submission date	28 June 2024
Nature	Report	Dissemination Level	Public
Lead Beneficiary	COBO		
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Contributions from	UA, IBI, INSY, MOBY, YUNEX		

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This project has received funding from the Horizon Europe research and innovation programme under the Grant Agreement No 101096664.

Revision history (including peer reviewing & quality control)

Version	Issue Date	% Complete[1]	Changes	Contributor(s)
v1.0	02/05/2024	0	Initial Deliverable Structure	COBO, SRM
v2.0	31/05/2024	90	First consolidated version sent for SPINE-internal peer-review (AIMSUN, ODRAZ, UNIZA).	COBO, SRM
v3.0	07/06/2024	95	Reviewed by AIMSUN, ODRAZ and UNIZA.	Juan Angarita (AIMSUN) Magdalena Makar (ODRAZ) Ghadir Pourhashem (UNIZA)
V3.1	17/06/2024	98	Reviewers' comments addressed.	COBO, SRM
V4.0	27/06/2024	99	Quality assurance by UNIZA.	Ghadir Pourhashem (UNIZA)
VF	27/06/2024	100	Final editing.	COBO, SRM
rVF	09/12/2025	99	Review of the document content following the request for revision requested by the Project Officer on 24 November 2025.	Silvia Bartoloni (COBO)
VF2	24/12/2025	100	Final editing in the new deliverable template elaborated at project level following the request of the Project Officer on 24 November 2025.	Chiara Lepori (SRM)

1 According to SPINE's Quality Assurance Process

Glossary of terms and abbreviations used

Abbreviation / Term	Description
ARPAE	Emilia-Romagna regional agency for the prevention of environment and energy
CO2	Carbon dioxide
CPOs	Charging Point Operators
GUTP	General Urban Traffic Plan
KPI	Key Performance Indicator
LEM	Local Evaluation Manager
LEZ	Low Emission Zone
LL	Living Lab
MaaS	Mobility as a Service
MS	Measure
PT	Public Transport
RFI	Rete Ferroviaria Italiana – Italian Rail Network
SaaS	Software as a Service
SCP	Smart City Platform
SFM	Servizio Ferroviario Metropolitano – Bologna Metropolitan Rail Service
SIAF	The tracking method introduced in SPINE to manage and monitor project progress. The acronym SIAF stands for the 4 life cycle phases of the project (Start, Implementation, Activation and Finish).
SULP	Sustainable Urban Logistic Plan
SUMP	Sustainable Urban Mobility Plan
TPM	Trasporto Pubblico Metropolitano – Bologna Metropolitan Public Transport

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1 Executive Summary

Deliverable D2.5, part of Work Package WP2, focuses on the Bologna LL, namely Task 2.3 in the SPINE GA, and describes the setup, operation and progress of LL developed in Bologna as a SPINE lead city from March 2023 to June 2024 (M3-M18). The general objectives of WP2 include: successful LL establishment, design and development of physical and digital common spaces, LL daily functioning and the implementation of LL-specific actions outlined in the subtasks described below. Actions are supported by the SPINE methodology, which involves the following steps: A1 – Empathize, A2 – Define, A3 – Co-create, and A4 – Prototype.

Task 2.3 includes four subtasks, associated to the following relevant contents of the deliverable:

- ST2.3.1 Operation of digital and physical LL spaces: D2.5 describes how actions are carried out for smooth operation, city-specific coordination of meetings, decision-making and co-creation process of solutions;
- ST2.3.2 City-specific digital enablers to the city-specific mobility solutions: D2.5 describes models and available data used, as well as stakeholders to be involved in the implementation for data sharing;
- ST2.3.3 Development and Implementation of SPINE mobility solutions: D2.5 outlines timeplan of the actions, and highlights risks and mitigation measures;
- ST2.3.4 Physical Impact Assessment: D2.5 reports the work made around the definition of city and solution specific KPIs.

D2.5 reports the above-mentioned elements with reference to the nine SPINE measures that are implemented in the Bologna LL, which are:

1. BOL_MS1 Multimodal Hubs, to integrate mobility services with innovative facilities to enhance passenger experience, improve public transport accessibility and promote multimodality;
2. BOL_MS2 EV Charging Stations, to support emission reduction and improve accessibility for users with special mobility needs;
3. BOL_MS3 Inclusive Services, to enhance accessibility, improve user experience, public transport accessibility and promote multimodality;
4. BOL_MS4 MaaS, to develop an integrated multimodal travel planner to enhance smart mobility in the metropolitan area;
5. BOL_MS5 City 30 km/h and LEZ, to support the introduction of 30 km/h zones and Limited Emission Zones citywide through communication and awareness campaigns;
6. BOL_MS6 Smart City Platform, to integrate diverse data sources to generate insights via specialized modules and KPIs, enabling better mobility planning and effective monitoring of measure implementation;
7. BOL_MS7 Micro-Incentives Programme via the Citizen Mobility App, to boost PT modal share and the intermodal travels;
8. BOL_MS8 Exploring logistic solutions supporting the reduction of CO_2 emissions and number of polluting vehicles in the city centre, based on the experience tested in the HE URBANE project;
9. BOL_MS9 PT Prioritization, to enhance public transport data quality and travel times, and improve green waves for PT to support City30 policy implementation.

2 Introduction

2.1 Mapping SPINE Outputs

Purpose of this section is to map SPINE's Grant Agreement commitments, both within the formal Deliverable and Task description, against the project's respective outputs and work performed.

Table 1: Adherence to SPINE's GA Deliverable & Tasks Descriptions

SPINE GA Component Title	SPINE GA Component Outline	Respective Document Chapter(s)	Justification
DELIVERABLE			
D2.5 Bologna LL and Implementation Version 1	Report including requirements and user stories, business model description	Chapter 3 Sections 3.1, 3. 2 and 3. 4	Sections 3. 1, 3. 2 and 3. 4 for each solution describe in detail how the measures are applied in Bologna, actors and stakeholders involved, and potential business model where and if applicable
	Report including a detailed implementation plan that defines the operational zone, operational parameters and fleet characteristics.	Chapter 3	Section 3.3 describes in detail the implementation plan for each solution, including related risks and risk mitigation plans
TASKS			
T2.3 CITY Bologna LL and implementation	Performs the corresponding actions relevant to the Bologna LL and implementation	Chapter 2 and Chapter 3	Chapter 2 describes the city context, stakeholders and operational details at the basis of the SPINE actions; Chapter 3 outlines the specific measures and the steps followed from M3 to M18
ST2.3.1 Operation of digital and physical LL spaces	Is related to the smooth operation of the digital and physical LL spaces	Chapter 2	The overall Bologna LL implementation plan with the measures/solutions is presented in Section 2.2.
ST2.3.2 City-specific digital enablers	Undertakes all city-specific digital enablers to the mobility solutions. In collaboration with the specific tasks of WP3, it supports the implementation of solutions via engaging the digital tools which will	Chapter 3	All Bologna's specific digital enablers to the mobility solutions are described with details in sections 3.2 to 3.10.

SPINE GA Component Title	SPINE GA Component Outline	Respective Document Chapter(s)	Justification
	facilitate the implementation process.		
ST2.3.3 Development and Implementation of SPINE mobility solutions	After receiving input from the digital impact assessment tasks of WP3, this subtask proceeds to develop and apply the mobility solutions in the city. This subtask carries out the implementation of the mobility solutions qualified	Chapter 3	In chapter 3, the specific sections related to the 9 measures applied in Bologna LL describe how they are applied in the city, who are the main actors and stakeholders involved, time-plan for action and steps taken from M3 to M18, as well as preliminary business plans if applicable
ST2.3.4 Physical Impact Assessment	Registers and monitors all physical impact indicators during and after the successful implementation of the innovative solutions in the city. It reports feedback and indicators to T2.6.	Chapter 2	In Section 2.1.3 and Annex A, City KPIs for monitoring of successful implementation of Bologna measures and solutions and the mapping with SUMP objectives have been described.

2.2 Deliverable Overview and Report Structure

The present deliverable D2.5 is based on the GA 101096664, to ensure alignment with project objectives, activities and expected outputs and results.

Chapter 1 summarizes the document structure and main contents.

Chapter 2 outlines Bologna's objectives and actions to improve urban mobility, LL context, operational details, working methodology and KPIs; in this chapter, reference to D1.1 Inception Report and D1.2 SPINE framework for innovative PT solutions has been made mainly to describe context and KPIs defined for Bologna.

Chapter 3 details the nine SPINE measures that are implemented in the Bologna LL, including their implementation, progress milestones, stakeholders involved and monitoring plan. Also, initial discussion on future business models is reported where applicable at the time of this deliverable.

Chapter 4 reports conclusions related to the first period of implementation of the SPINE measures in Bologna LL (M3 - M18).

Finally, the Annex A provides the KPIs chosen in collaboration with WP1 for the Bologna LL.

3 SPINE Living Lab CITY

3.1 Bologna LL objectives

3.1.1 City context

Bologna faces significant mobility challenges due to its location in the Italian geography, the dense population and its historical and cultural importance. It is one of Italy's larger cities, with a population of over 390,000 inhabitants and 1 Mio in the whole metropolitan area, and it is also a major transport and logistics hub. The city's urban public transport system handles a considerable flow of passengers each year. However, the prevalent use of private cars remains a hurdle, accounting for 42% of the transport modes used, followed by walking at 27% and Public Transport (PT) at 21%.

The Bologna metropolitan SUMP was approved in 2019; it was the first in Italy - and one of the few in Europe - to deal with a whole metropolitan area, and gave birth to the Metropolitan Public Transport network, i.e. a network of integrated connections that replaces the concept of subdivision of PT in urban and suburban networks.

Currently, the city has a wide offer in terms of mobility services (car-sharing, bike-sharing, parking, taxi and buses), operated by private and public companies. In 2021, the PT operator "Trasporto Pubblico Bologna" (TPB) transported roughly 96.5 million passengers in the Bologna catchment area, offering a total of 36.5 Mio kilometers of urban, exurban and suburban connections. The city's mobility offer has evolved in recent years to include tourist buses and "mini-trains" (San Luca Express and CityBO Express) operated by City Red Bus.

The Metropolitan Rail service (SFM – Servizio Ferroviario Metropolitano) provides train services to the municipal and metropolitan area. There are also some connections with cities outside the Bologna metropolitan area, such as Prato, Modena and Ferrara. In total, the SFM network covers 67 train stations (10 of them in the Bologna municipality) and 350 km of rail-lines (280 km of them in the territory of the metropolitan city of Bologna). In 2021, around 12.6 Mio passengers used the service.

Besides the Metropolitan Rail Service, the SUMP planned the introduction of a new tram-type rapid transport system for the urban area of Bologna, that will be integrated with the public road transport. The infrastructural works, recently started, will lead to the construction of 4 new interconnected tram lines over the next few years.

As far as cycling mobility is concerned, half of the journeys in the metropolitan area are under 5 km and from these distances, easily cyclable, the challenge is to bring about an ultimate change in habits and mobility styles. The Bicipolitana project consists of 34 lines of which 20 lines for everyday travel and 14 lines dedicated to leisure and cycling. Additionally, the city is working on the opening of cycle parks and cycle-stations in the new mobility hubs, as well as on an extension of the services allowing people to bring their bicycle on trains.

Another new city challenge started in late 2023 and regards the reduction of the speed limit to 30 km/h in the whole city area from the beginning of 2024 (https://www.bolognacitta30.it/), with the main aims to reduce accidents and increase road safety, increase liveability of public spaces, and reduce polluting emissions.

The implementation of a wider Low Emission Zone (LEZ), extended to the whole urban area, will also contribute to emission reduction and will support the use of PT and sustainable and active transportation modes.

Last but not least, Bologna is one of the 112 cities selected to join the EU Mission 100 Climate-neutral and smart cities by 2030 (https://www.bolognamissioneclima.it/).

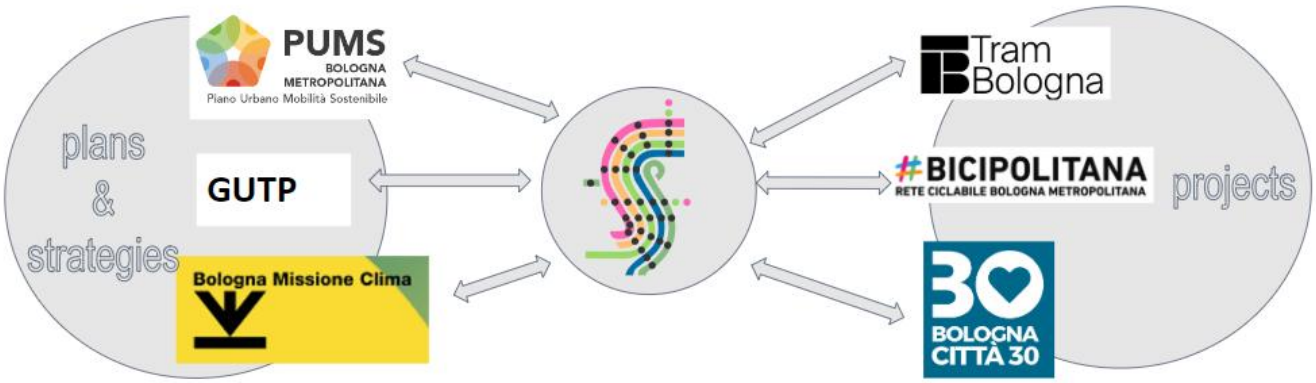

Figure 1: Bologna projects and strategies

In Bologna, PT is characterized by a high level of digitalization: (i) the bus fleet is GPS controlled, providing data about the performance of the service, and the possibility to provide real-time information to passengers; (ii) the bus tickets can be purchased through a mobile app or on-board with debit/credit card (as well as from ticket machines, kiosks and resellers).

Bologna traffic management is supported by the U.T.O.P.I.A system (Urban Traffic Optimization by Integrated Automation), which consists in a traffic light control and regulation platform including the following features: tool for analysis, planning, control & management of public & private mobility; optimization of traffic light phases through sensors integrated in the asphalt.

As a high-level objective, Bologna aims to reduce traffic emissions by 40% by 2030 compared to 1990. The SUMP seeks to implement a modal shift in the mobility system, increasing the PT share to 19%, bicycle usage to 14%, and reducing car usage to 41% in the same period in the territory of the Metropolitan City, while aiming at modal shares equal to 28%, 18% and 22%, respectively, for the municipality of Bologna (see Figure 2).

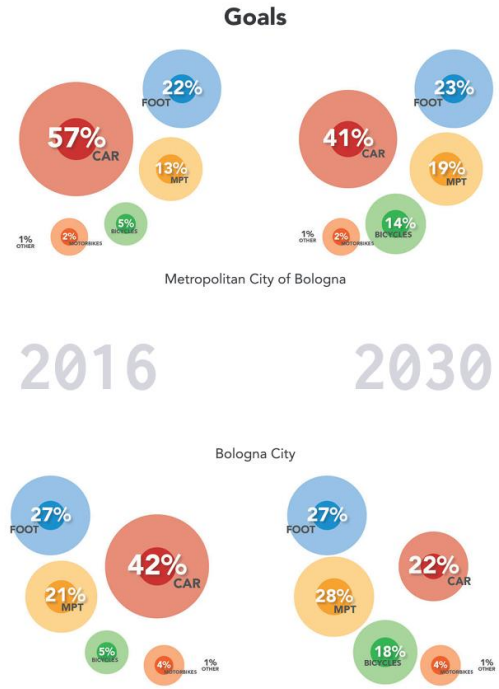

Figure 2: Bologna SUMP modal shift goals to 2030

In this context, the main goal of SPINE in Bologna is to increase the use of public transport and, more broadly, the usage of climate-friendly and active modes of transportation, by developing actions promoting multimodality and sustainable transport options. An urban laboratory (Living Lab - LL for short) engages all key stakeholders and all different categories of users in the actions of identifying and implementing innovative and improved solutions for a better mobility. To this end, the SPINE project in Bologna has four main objectives:

- Increasing the public transport share by 30%, with a particular emphasis on improving multimodality quality at three selected Multimodal Hubs and on developing specific incentives campaigns;
- Improving public transport user satisfaction by 25% through the implementation of digital solutions to enhance system-wide efficiency;
- Reducing the number of most polluting vehicles entering the city area by 100%, encouraging the transition to low or zero-emission vehicles and supporting sustainable transportation alternatives and active mobility;
- Reducing CO2 emissions by 20% by encouraging the use of sustainable transportation modes and technologies.

3.1.2 LL use case(s) and requirements

The main goal of Bologna LL is to increase the use of public transport by the citizens and city users and, more broadly, to promote the use of climate-friendly and active modes of transportation, by developing different SPINE measures as solutions able to promote sustainable transport.
The number of public and private mobility services offered by the City of Bologna is large, from PT (buses and trains) to car-sharing, bike-sharing, scooter-sharing, parking areas and taxi. However, the prevalent use of the private car remains an obstacle for the achievement of the objectives of the SUMP.
For this reason, Bologna LL represents a strategy to enhance sustainable and active modes of transport through a user-oriented lens in urban centres. This strategy will be implemented through the development of nine solutions, which are presented in the following with their respective use case and the requirements:

- BOL_MS1 Multimodal Hubs
  - The aim of the 3 Multimodal Hubs in Bologna is to offer to the users an innovative, inclusive and accessible physical place that connects a variety of transport modes.
  - [UC] Citizens and mobility users will use the innovative and inclusive mobility services at the Multimodal Hubs, increasing their experience and satisfaction. The interactive screens, improved with new inclusive features will provide them with real-time information regarding arrivals, delays, and possible crowding of buses and train carriages. The deployment of efficient colour markings will help the passengers in orienting themselves among the various transport options, while the digital signages will inform and entertain them while waiting. The use case will be tested in the three multimodal hubs and could be, in the future, transferred to the 9 city-level hubs and the 30 in the metropolitan area that will be equipped- with new services as part of the Bologna SUMP.
  - [R] COBO will deal with local transport operators and car and bike sharing companies that will be involved in the implementation of the measure, based on the specific needs of each hub to improve their offer / service to the final users. COBO is also responsible for the negotiation with the provider/s of digital informative and interactive infrastructures, and with electricity and internet service providers.
- BOL_MS2 EV Charging Stations

- At the moment, in the Bologna area there is a limited number of EV charging stations within 250-metres from the train stations. Only the Mazzini station, one of the 3 selected Multimodal Hubs, has one of them. This situation does not incentive city users to use climate friendly modes of transport, such as electric cars, bicycles and scooters.
- [UC] Thanks to the Bologna LL, city users will be able to charge their transport means at EV public parking spaces surrounding the stations.
- [R] EV charging stations will be equipped with accessibility interventions, such as special plugs accessible to wheelchair users, in order to meet also the needs of users with special mobility requirements.

- BOL_MS3 Inclusive Services
  - Inclusive services will bridge the accessibility and information gaps at the selected hubs and ensure that mobility is equally accessible and available to every user.
  - [UC] Inclusive services will provide accessibility features for the EV charging stations that will be installed at the Multimodal Hubs to make them accessible to people with disabilities. EV charging stations will be equipped also with systems that can be comfortably used for electric wheelchairs. Multimodal Hub users will have at their disposal other inclusive services that will provide them with relevant information for all the different types of users.
  - [R] Inclusive services will include ramps, cover / small roof and other inclusive tools to correct accessibility problems and limitations. Multimodal Hubs will be equipped with braille and audio communication (in different languages) for visually impaired users; furthermore, visual instructions and efficient colour marking for hearing-impaired users will be included in digital signages and digital kiosks.

- BOL_MS4 MaaS
  - The MaaS solution aims at improving smart mobility in the metropolitan area. MaaS is a concept that brings together different modes of transport into a single, comprehensive, and on-demand service. By providing simplified access to diverse transport options, the MaaS planner promotes a shift towards more sustainable transport modes, reducing negative impacts of car traffic.
  - [UC] Users will be able to calculate their multimodal trips and to choose their best travel option (in terms of travel time, sustainability, accessibility, etc.) by using a common coordinated and integrated IT platform. The MaaS platform could also provide data to the information services located at the SPINE multimodal hubs. The city will directly benefit from this solution, thanks to a deeper understanding of mobility data management and integration. In the future, the tested MaaS planner could be expanded regionally.
  - [R] The IT provider INSY, in collaboration with SRM and COBO, will integrate several mobility data and services into a single access point, including PT, bike sharing, car sharing and park-and-ride. Real-time and historical information regarding the public transport are the core features of the MaaS app.

- BOL_MS5 City 30 km/h and LEZ
  - This solution supports the introduction of a low emissions zone (LEZ) which is based on the City of Bologna's SUMP initiative known as the Green Area, and the City 30 (km/h) concept. The goal is to improve air quality in the LEZ and to reduce the speed limit in the whole urban area, ensuring increased security for the citizens and all street users.
  - [UC] Active mobility users will benefit from an increased road safety and from the reduction of GHG emission.

- [R] COBO will implement this solution through 3 different actions: (i) from the communication side, COBO will develop awareness raising activities about the City 30 policy; (ii) COBO installed 30 cameras at the main entrance corridors in order to monitor the type of vehicles accessing the urban area (not with SPINE resources); (iii) COBO collects data throughout the year 2024 (not with SPINE resources) and works on prioritization on selected routes and PT lines through the AIMSUN simulation model.

- BOL_MS6 Smart City Platform
  - Smart City Platform (SCP) is a Software as a Service (SaaS) application that can be integrated with a variety of data sources and pull&push information by using APIs and data ingestion procedures. It is a solution geared towards the needs of cities and municipalities because it offers the possibility to integrate and analyse all information and data related to the local conditions.
  - [UC] COBO and the mobility operators will be assisted in managing their operations and assets and in monitoring the SPINE-related mobility measures through targeted KPIs, with the aim of improving the planning of mobility services.
  - [R] IBI, the SPINE technological partner that will implement the SCP, has to collect and analyse data from various sources.

- BOL_MS7 Micro-Incentives Programme via the Citizen Mobility App
  - The Micro-Incentives Campaign will be directed to a selected range of users, whose involvement will be done and measured through the Citizen App.
  - [UC] Through the Citizen App, the target users of the campaign will participate directly in the SPINE project, engage with the co-creation of solutions and "generate" the impact of the proposed measure. The Campaign will track the users' home-to-work commute by any means of transport and they will collect points (and gain prizes) on the basis of the level of sustainability of the transport means used.
  - [R] The SPINE technological partner in charge of this solutions, MOBY, will customize and test the existing Citizen App to adapt it for the Micro-Incentives Campaign.

- BOL_MS8 Exploring logistic solutions supporting the reduction of CO_2 emissions and number of polluting vehicles in the city centre
  - This solution focuses on improving freight operations in the urban environment, implementing a last-mile delivery service in the urban logistic chain.
  - [UC] Citizens and mobility users will benefit indirectly from this solution thanks to the reduction of CO_2 emissions and of polluting vehicles within the city centre.
  - [R] COBO will advance the activities implemented as part of the Horizon Europe URBANE project and undertake an analysis to explore innovative solutions for the optimization of PT in low congestion peak hours, and/or other kinds of possible improvement of Nearby Delivery Areas.

- BOL_MS9 PT Prioritization
  - The objective of PT Prioritization is to enhance PT reliability, reduce travel times, and optimize green waves. This is achieved through the analysis of the current PT prioritization system and the elaboration of suggestions for possible improvements.
  - [UC] Thanks to the implementation of this measure, active mobility users will benefit from an increased road safety and from the reduction of GHG emission.
  - [R] YUNEX, the IT technology provider, will provide the analysis of the current system and elaborate suggestions for its potential improvement. Data for the analysis are provided by SWARCO, which

is the provider of the Municipality of Bologna and owns the system that manages traffic lights regulation in the city.

Bologna LL prioritizes the construction of multimodal hubs, new digital solutions and services and promotes a coherent and integrated approach to urban mobility planning. By putting the nine SPINE solutions into practice, the city of Bologna will reshape urban mobility and create a more sustainable transport systems adaptable to the evolving needs of the users. As ultimate goals, the implementation of the nine measures is expected to increase PT share and user satisfaction and to reduce the number of most polluting vehicles entering the city area, leading to a reduction in CO2 emissions.

3.1.3 City KPIs and mapping with SUMP objectives

In connection with WP1, and as reported in deliverables D1.1 and D1.2, a mapping of the maturity level of the city mobility context and ecosystem in relation to the initial basket of foreseen interventions was carried out to end up with a consolidated list of SPINE measures for Bologna.
Through the discussion with WP1 leaders, the main KPIs were identified for each of the measures in the LL, as well as their baseline, target values and means of verification. Selected KPIs align SPINE measures foreseen for Bologna to the SUMP objectives, and specifically:

- Increase of PT share;
- Increase of user satisfaction;
- Reduction of polluting vehicles in the city area;
- Reduction of CO2;
- Reduction of private car use.

A discussion between WP1 leader UAEGEAN and the lead cities is still going on, since SPINE project's main KPIs need to be aligned among SPINE cities and with KPIs identified by sister project UPPER, resulting in a live process of further refinement of KPIs for SPINE cities, including Bologna.
The list of KPIs which has been defined for Bologna LL so far, with baseline and target values and foreseen monitoring method is reported in the Annex A.

3.2 Overall Implementation plan

3.2.1 High-level timeline of implemented solutions

The overall Bologna LL implementation plan with the measures/solutions is presented in the Figure 3 below. In order to give a general overview of implementation of SPINE measures in Bologna, the SIAF tracking method is used. The SIAF management tool was created by WP2 leader ANTW in order to monitor the progress and / or possible delays of lead cities activities. Single detailed timelines for each specific measure are presented in chapter 4. The implementation plan reports local and project measure ID, measure name, foreseen duration of the SIAF phases (start, implementation, activation and finalization) for each measure and relevant changes happened so far due to delays of impacting factors.

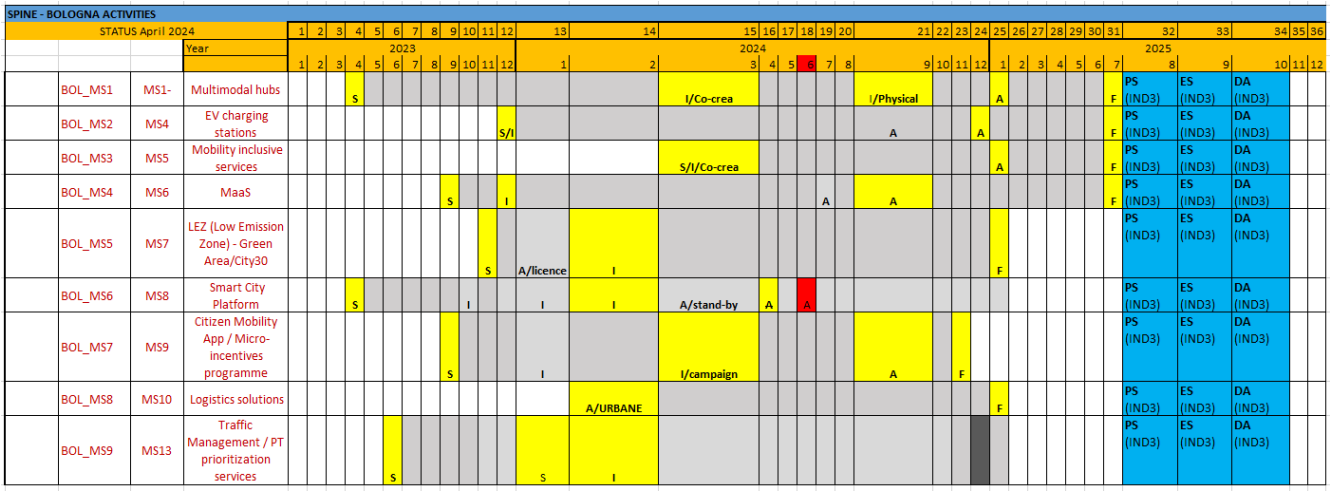

Figure 3: Implementation Plan Overview and Monitoring Measures for SPINE in Bologna

3.2.2 Operational plan (on city level)

Operational factors

Bologna LL actions include both physical and digital measures. Both action categories concentrate on the urban area but, as far as transportation modes are concerned, they both target the whole metropolitan area. The main reason for this wider perspective is that the Bologna mobility system is a network of integrated connections referring to the Metropolitan Public Transport, as explained in section 3.1.1.

Bologna physical measures are mainly linked to Multimodal hubs (BOL_MS1). Three urban hubs were selected for the SPINE actions: Mazzini, Corticella and Casteldebole. The reasons for this choice will be explained in detail in section 4.2. The measures BOL_MS2 EV charging stations and BOL_MS3 Inclusive mobility services are therefore connected to the BOL_MS1 main action.

As regards the implementation of digital measures (BOL_MS4 MaaS, BOL_MS5 LEZ–Green Area/City30, BOL_MS6 Smart City Platform, BOL_MS7 Citizen mobility app/Micro-incentive programme and BOL_MS9 Traffic management/PT prioritization services) data come from:

- City mobility open data (such as: daily pedestrian mobility, traffic flows, bicycle traffic flows, ARPAE system air quality measurement, local public transport kms covered and ticket validations, mobility infrastructures, 30 km/h zones, traffic accidents, traffic violations, SIT Territorial Information System for vectorial cartography of the urban area, street graph and georeferencing of traffic elements, etc.);
- Data from mobility operators on a metropolitan and city level (buses, SFM – Metropolitan Rail System, car and bike sharing, taxi companies, monorail service connecting the airport to the city, parking spaces, private cars and buses with driver);
- Data from existing mobility management IT systems (as reported in D1.2):
  - U.T.O.P.I.A. (Urban Traffic Optimization by Integrated Automation): traffic light control & regulation platform for analysis, planning, control & management of public & private mobility (e.g. optimization of traffic light phases with sensors embedded in asphalt);
  - SIRIO: electronic control of access to historic centre/Low Transport Zones via cameras and sensors that are connected to the local police control centre;

- RITA (Rete Integrata di Telecontrollo degli Accessi) checking pedestrian, semi-pedestrian zones and reserved (priority) lanes every day, 24/7 by detecting the transit of all vehicles;
- SARA: electronic control of access to priority lanes;
- SIT Territorial Information System, includes vectorial cartography of the urban area; street graph; georeferencing of all traffic elements: traffic lights, inductive loops, variable message signs (VMS), cameras;
- STARS (Sanzionamento Transiti Abusivi Rosso Semaforico): system for detecting and sanctioning of traffic violations involving red traffic lights, managed by the municipal police;
- SCOUT Sosta: device installed on board the service vehicles of the local police for facilitating public transport (double-parking, parking at bus stops or fast lanes, etc.) and making the mobility of bicycles and pedestrians safe;
- Scout Speed: device installed on board local police service vehicles for dynamic speed control on city roads to prevent dangerous driving behaviour.

For BOL_MS5 LEZ – Green Area/City30 and BOL_MS9 Traffic management/PT prioritization services, specific main PT corridors have been selected in the city centre in order to carry out a qualitative analysis of the current PT prioritization system (PTV VISUM transportation macroscopic model for the entire metropolitan area from 2018) and linked simulation models for further improvement, as explained in detail in section 4.1.

As regards BOL_MS8 Logistic solutions, the operational area is the area of the local pilot developed within the URBANE project, which is testing an innovative solution for sustainable and collaborative last mile logistics for the historical urban area. Microhubs for the transshipment of parcels from traditional carriers to small EV have been installed and are currently being tested at three locations on the ring road surrounding Bologna historic centre: Via Calori, via Berlinguer and Piazza San Mamolo (details in section 4.9). Moreover, a logistic DT platform is currently under development within the scope of the same URBANE pilot, which is expected to support stakeholders in monitoring the pilot and planning future measures.

Operational details

One of the key actions carried out in the first phase of the project was the mapping of city mobility stakeholders, aimed at their early involvement in project implementation.

The Bologna key institutional and private stakeholders for SPINE are summarized in the Table 2 below.

Table 2: Key Bologna SPINE stakeholders

Bologna LL stakeholder name	Description
Bologna airport	Bologna Airport Marconi Spa is the management company of Bologna Airport. Ranked as a strategic airport in the National Airport Plan and located in the heart of the Emilian Food Valley and automotive and packaging industrial districts, Bologna Airport has a catchment area of about 11 million inhabitants and around 47,000 companies with a strong inclination towards export and internationalization.
Arpinge spa	Arpinge is a private and institutional investment company that operates in the infrastructure sector and in some real estate categories.

Bologna LL stakeholder name	Description
Bomob S.c.a r.l.	Bomob carries out the management of parking services and the issuing of badges and permits in the territory of the Municipality of Bologna.
Metropolitan City of Bologna	The Metropolitan City of Bologna, located in the Emilia-Romagna region of Italy, was established by the reform of local authorities and officially replaced the Province of Bologna in 2015. Its chief city is effectively the city of Bologna. The Metropolitan City is governed by the Metropolitan Mayor and the Metropolitan Council.
Cosepuri	COSEPURI is a consortium specialized in transportation services, including both individual and collective passenger and freight transport, as well as managing local public transportation.
ENI spa	Eni spa is a global technology-driven energy company operating on a global scale in 62 countries with over 32,000 employees. It is involved in oil, natural gas, chemistry, biochemistry and the production and marketing of energy from fossil fuels, cogeneration and renewable sources.
Fondazione IU Rusconi Ghigi	The Foundation for Urban Innovation Rusconi Ghigi (FIU) is a multidisciplinary centre driving urban transformation through research, development and communication. It fosters collaboration between public administration, universities, businesses and citizens, focusing on innovative governance, ecological transition and cultural democracy. FIU designs and manages urban transformation processes, facilitating public dialogue and co-production among various stakeholders to construct shared urban spaces and services.
Marconi Express	Marconi Express is an automated people mover system connecting Bologna-Borgo Panigale Airport with Bologna Centrale railway station, with an intermediate stop at the Lazzaretto university campus.
Metropark (Gruppo FS)	Metropark is a company that provides solutions for parking and integrated mobility for people in various parking areas at major railway stations and is 100% controlled by FS (Ferrovie dello Stato).
TPB/TPER/Omnibus Scarl	TPER (Emilia-Romagna Passenger Transport) manages road transport in Bologna and Ferrara and the Emilia-Romagna regional railway service.
Parkinge srl	Parkinge Srl, a subsidiary of Arpinge, has emerged as Italy's top investor-concessionaire in parking and the fourth-largest operator in the country.
Regione Emilia-Romagna	Emilia-Romagna is an ordinary statute region in northeastern Italy. The chief city is the metropolitan city of Bologna and the current president is Stefano Bonaccini.
Ridemovi spa	RideMovi is the leading Italian company in the shared micromobility sector in Europe. The app enables users to locate, unlock, ride their preferred mode of transportation (bike, e-bike, e-scooter), and park in public areas.

Bologna LL stakeholder name	Description
Saca	The SACA Cooperative offers chauffeur-driven car rental services and has expanded into bus and other vehicle rentals in Emilia Romagna and throughout Italy. SACA offers a wide range of services, including the new Transit Point service for logistics of goods in Bologna.

On September 14th, 2023, all stakeholders were invited to a first workshop where the SPINE project at the EU level and SPINE Bologna actions were presented. The workshop aimed at the early involvement of key stakeholders in project actions, at gathering interest around SPINE potential and at creating value for stakeholders in order for them to understand the benefits of project measures for the whole Bologna mobility scenario.

Additionally, this first meeting had the purpose of opening a communication channel with the stakeholders and to ease the dialogue around the following implementation of project measures. After the workshop, a follow-up document was elaborated and shared with the stakeholders to collect their first feedback needed for the implementation of SPINE actions in the city.

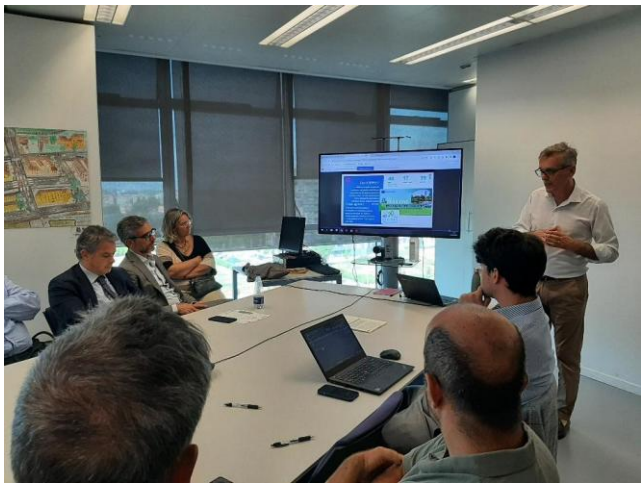

Figure 4: SPINE stakeholders' workshop, 14 September 2023 and SPINE follow-up technical – operational document for stakeholders, December 2023

The SPINE Bologna team is composed of the two beneficiaries Municipality of Bologna (COBO) and SRM–Società Reti e Mobilità S.r.l. (SRM), the Agency for mobility and local public transport of the Municipality of Bologna and the Metropolitan City of Bologna, that is the local Public Transport Authority (PTA).

COBO and SRM coordinate different measures in the framework of Bologna SPINE Living Lab.

COBO is in charge of:

- BOL_MS1 Multimodal Hubs;
- BOL_MS2 EV charging stations;
- BOL_MS3 Inclusive mobility services;
- BOL_MS5 LEZ (Low Emission Zone) - Green Area/City30;
- BOL_MS6 Smart City Platform;
- BOL_MS8 Logistic solutions;

- BOL_MS9 Traffic Management / PT prioritization services.

While SRM is in charge of:

- BOL_MS4 MaaS;
- BOL_MS7 Citizen Mobility App / Micro-incentives programme.

Nevertheless, the implementation of all the different measures needs a continuous dialogue and collaboration between the two beneficiaries, since they work on a series of common elements such as key stakeholders and available city data. Additionally, it is foreseen that tools implemented within the different measures will feed each other; some examples are the MaaS-like intermodal travel planner, which will ideally feed the information services at the SPINE multimodal hubs, and the Micro-incentives campaign which will need the support of the Municipality for reaching the target users.

For this reason, there are continuous exchanges between COBO and SRM working teams, both for internal discussion and for external dialogue with local stakeholders and with SPINE technological partners, other cities, the SPINE project coordinator and the WP leaders.

Moreover, COBO and SRM together join the monthly WP2 meeting organized by WP2 leader ANTW, when the state of the art of Bologna LL implementation, together with encountered barriers and challenges, are regularly presented.

Other structural meetings concern the co-creation aspects of the project. Preliminary sessions were held between COBO, SRM and the Foundation IU Rusconi Ghigi (operational arm of the Municipality dealing with participative processes) to establish goals, define roles and gather input on optimizing the co-creation experiences. In preparation for each co-creation meeting, a detailed agenda with the topics to be addressed is defined, as well as tailored presentation sessions are prepared to provide context, feed structured discussion sessions to explore specific questions or topics, and encourage brainstorming activities to generate new ideas and solutions.

Additionally, both for actions planning and implementation, Bologna core decision team needs to constantly align with mobility operators, stakeholders and target groups; this is needed also to ensure that the Bologna LL measures can have a deeper impact at a local level. The team also takes care of coordinating the LL actions with the other SPINE cities and with sister projects, which guarantees that the SPINE local actions can also feed the discussion on sustainable mobility at EU level.

As regards alignment with other city projects and actions, it is important to report that both COBO and SRM are following the works of the Bologna city table on Digital Twin, that is pursued through the participation of various city organizations in various EU projects. This activity is carried out through a bi-monthly working table involving institutional and mobility city stakeholders that keeps track of the advancements and explore possible synergies in the field of DT experiences carried on by different actors of the Bologna territory through EU funded projects.

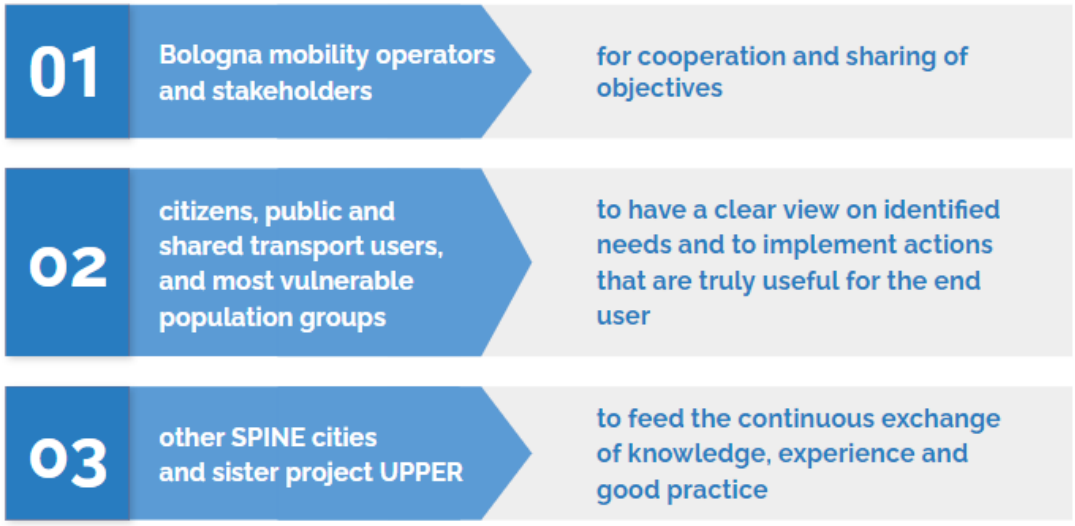

Figure 5: Synergies and collaborations around SPINE local actions

Consulting citizen groups is fundamental to enrich the design and implementation of urban projects, as it brings a broader and more diversified perspective, ensuring that the voices of all - including marginalized groups and fragile categories - are heard. This increases the legitimacy of decisions made by local authorities leads to more innovative and effective solutions that can address the specific needs of the community.

In the context of the SPINE project, detailed information about mobility access barriers were obtained and the community's priority needs were identified by directly involving target groups and end users of transport services.

The SPINE Bologna LL co-creation activities mainly concern the implementation of BOL_MS1 Multimodal Hubs, to which also measures BOL_MS2 EV charging stations, BOL_MS3 Inclusive mobility services and BOL_MS4 MaaS are directly linked.

The different stages of the participatory process are presented in Table 3 below, from the initial planning and preparation phases to the collection of feedback. Those stages adhere to the principles of the SPINE methodology - namely the Equity Centred Design Thinking Approach based on six steps: empathize, define, ideate, prototype, test, amplify. The various steps are not listed chronologically, as they permeate the entire process in a cross-cutting manner, while also applying horizontally to each individual engagement activity undertaken.

Table 3: Stages of the Participatory Process according to SPINE'S Equity Centred Design Thinking Approach

Step	Time	Activity	Description	Objective
Pre-activity planning	January 2024	Meetings for the selection of target groups and end users and definition of the participatory process.	Initial meetings to identify key target groups and plan how to involve them.	Definition of participants and process.
Preparation of activities	January 2024	Preparation of communication materials and	Preparation of documents and information materials to involve target groups and end users.	Preparation of the means of communication

Step	Time	Activity	Description	Objective
		organization of preparatory meetings.	Organization of preliminary meetings to clarify the objectives and expectations of the process.	and initiation of the process.
A1-Empathize	February-May 2024	Organization of interactive events: focus groups, questionnaires and surveys, school labs.	Implementation of physical and digital events to explore user needs.	Involving target groups and end users directly to better understand their needs and establish trust.
A1-Empathize	February-March 2024	Focus group with Consultative committee for overcoming disabilities, Diversity team, Women, elderly people, migrants' consultation committees, Cycling and environmental consultation committees[2]	Thematic focus groups to gather stimuli on attractiveness, inclusion, accessibility in sustainable mobility.	Engage target groups and end users directly to understand their needs.
A1-Empathize	April-March 2024	Questionnaires for students and commuters.	Distribution of questionnaires to gather feedback on the needs and challenges in the daily commuting of students and commuters, informing on the development of SPINE solutions	Gather direct input from young people and commuter users of the city mobility system.
A1-Empathize	May 2024	School labs with schools located around the SPINE Bologna LL multimodal hubs	Children involved in co-creative workshops where they reinvent road signs, expressing their vision of traffic and road safety around the multimodal hubs	Empathize with the perceptions and needs of special categories of users.
A2 - Define	May–June 2024	Analysis of the collected data.	Analysis of the results of the workshops, questionnaires and focus groups to identify the main themes and recurring	Synthesize data to identify common and specific needs.

[2] Consultation committees are consultative bodies established by the Municipal Council of the Municipality of Bologna, for specific thematic objectives. They are open to the participation of associations, Third Sector entities and social groups and can express opinions on administrative acts and city policies and projects. Additionally, the Diversity Team acts transversely to the other bodies and consists of five experts appointed by the Municipality to promote more inclusive, accessible and adaptable services for all people. Its goal is to support the municipal administration in creating an operational strategy to manage and enhance diversity in all its dimensions.

Step	Time	Activity	Description	Objective
			needs among the different categories of citizens involved.	
A2 - Define	May 2024	Mapping of needs	Elaboration of a needs map, which highlights the main problems and needs identified during the empathizing phase.	Formalize needs in a clear and organized way.
A2 - Define	January 2024	Definition of interventions and indicators.	Setting objectives and key performance indicators (KPIs): • 3 focus groups with associations representing SPINE target groups • 3 School Labs (1 per multimodal hub area) • 60-100 people representing target groups reached through questionnaires and surveys	Structure an action plan, with clear objectives and indicators.
A3 - Ideate	February-May 2024	Brainstorming sessions and co-design workshops.	Involvement of target groups and end users in brainstorming sessions and co-design workshops to develop innovative ideas and solutions that respond to the needs that emerged in the previous phases.	Generate ideas based on real user needs and collaborate to create practical and shared solutions.
A3 - Ideate	February-May 2024	Idea incubator: use of digital tools and role playing.	Structuring teams with diverse perspectives to promote debates and reflections. Using tools such as physical and virtual whiteboards (e.g., "Miro") to facilitate dynamic community engagement; administering questionnaires; creative ideation activities for children (e.g. role playing "Personas" method).	Incubate and develop innovative ideas through collaborative and creative approaches.
A3 - Ideate	May-June 2024	Feedback on proposed solutions and drafting of a final report.	Collect feedback from citizens to further refine proposals, ensuring they are practical and responsive to identified needs.	Refine solutions through feedback-based iterations.

The Bologna LL SPINE co-creation process represents a dynamic and collaborative process to generate innovative ideas, develop practical solutions and take decisions that meet the needs of all involved target groups.

The working method proposed by FIU for the meetings included the use of physical and virtual boards (such as the "Miro" board with virtual post its), to facilitate dynamic community engagement, allowing the participants to express their needs and suggest solutions to make mobility more accessible.

During the focus groups, facilitators led discussions and activities effectively, ensuring to all participants the opportunity to contribute to the achievement of meeting objectives. The environment was set to be open, inclusive and respectful to encourage constructive discussion and open sharing of ideas and perspectives.

Figure 6: SPINE focus group with the Cycling and environmental consultation committees, March 2024

Figure 7: SPINE interviews to city visitors on mobility and multimodality needs at tourist info points and SPINE School Labs, May 2024

4 SPINE Living Lab Bologna Applied Measures / Solutions

4.1 LL key information and main elements

The Bologna LL implements nine measures among the 14 developed in SPINE. Those measures are chosen as they are considered solutions able to enhance the mobility in the city and contribute to the achievement of the SUMP objectives, the latter being linked to the LL objectives as well.

Two elements reported below apply to more than one Bologna measure, therefore they are identified as transversal information across the Bologna LL:

- **Unforeseen internal / external factors impacting on solutions, and barriers/opportunities to implementation** (valid for all Bologna LL solutions): Identifying both foreseen and unforeseen factors impacting on the development of solutions in the framework of Bologna LL is part of the Task 2.6 LLs lessons learned and barriers' identification. Task 2.6 is led by COBO with the support of local partner SRM and the WP2 leader Antwerp. All factors identified in Bologna, as well as in the other SPINE Lead Cities are regularly collected through a specifically created tool, namely the "Event Logbook for SPINE cities", which is hosted on the SPINE project intranet and is accessible to all cities. Elements related to the first phase of the implementation of SPINE measures in cities are reported in D2.1 LLs Report and Legacy Version 1;
- **Digital impact assessment process & impact - Digital Twins simulations, behavioural models, configurable what-if analysis:** in the framework of Bologna LL, two main models will be applied:
    a) Traffic simulation model by AIMSUN (valid for BOL_MS5, in connection with BOL_MS9) will be used to simulate new possible scenarios for PT prioritization in connection with BOL_MS5 supporting City30 policy implementation; for this simulation model, AIMSUN will work in connection with YUNEX PT prioritization analysis (BOL_MS9);
    b) Behavioral Change Model developed by CAMBIAMO, (mainly valid for BOL_MS1, BOL_MS3, BOL_MS4, BOL_MS5 and BOL_MS6 and BOL_MS7) aimed at identifying psychological and social factors that can influence travel behaviors of people among the various modes of transportation, in order to find key factors that can nudge toward a modal shifting to PT.

4.2 BOL_MS1 Multimodal Hubs [MS1 - Multimodal hubs]

4.2.1 Description and experimentation area

This measure focuses on the implementation of collaborative mobility in three multimodal hubs located in the urban area of the city within 5-6 kms from the historical city centre. The aim is to integrate offered mobility services and equip multimodal hubs with innovative and inclusive facilities, to improve passengers' experience and satisfaction. This includes:

a) on-site interactive screens as well as speakers and braille displays to provide real-time information to passengers regarding arrivals, delays, and possible crowding of buses and train carriages;
b) deployment of efficient color markings;
c) digital signages at the hubs to inform and entertain passengers while waiting;
d) accessible EV charging stations.

BOL_MS2 and BOL_MS3 can be considered as sub-solutions of BOL_MS1, as EV charging stations and Inclusive mobility services are part of the actions targeting the Multimodal Hubs improvement.

Mazzini hub, April 2024

Corticella hub, April 2024

Casteldebole hub, April 2024

Figure 8: Photos of the three Hubs: Mazzini, Corticella and Castel Debole

4.2.2 Actors and stakeholders

The main implementer of BOL_MS1 is the Municipality of Bologna (COBO), even though some of the new features implemented in the three selected Multimodal Hubs will also be fed by measures developed by SRM in the context of SPINE (e.g. BOL_MS4 MaaS) as far as digital services such as information screens and interactive kiosks are concerned.

Involved actors and technical partners (and their role) include:

- Local transport operators and car and bike sharing companies, to be involved in the implementation of the measure based on the specific needs of each hub in order to improve their service to the final user (e.g. provision of services where absent; data on their services to be conveyed through the new digital informative solutions);
- Stations owner company (RFI), for alignment with SPINE interventions;
- Other COBO's units planning interventions in the same area (Tram, Bicipolitana) for alignment and coordination;
- Charging Point Operators (CPOs);
- SPINE tech partner dealing with MaaS solution BOL_MS4 (INSY), which will be included among the new services at the hubs;
- Co-creation target groups for further refinement or verification of the implemented solutions;
- Provider/s of digital informative and interactive infrastructures (to be contracted by COBO);
- Electricity and internet service providers (to be contracted by COBO).

4.2.3 Detailed Implementation plan

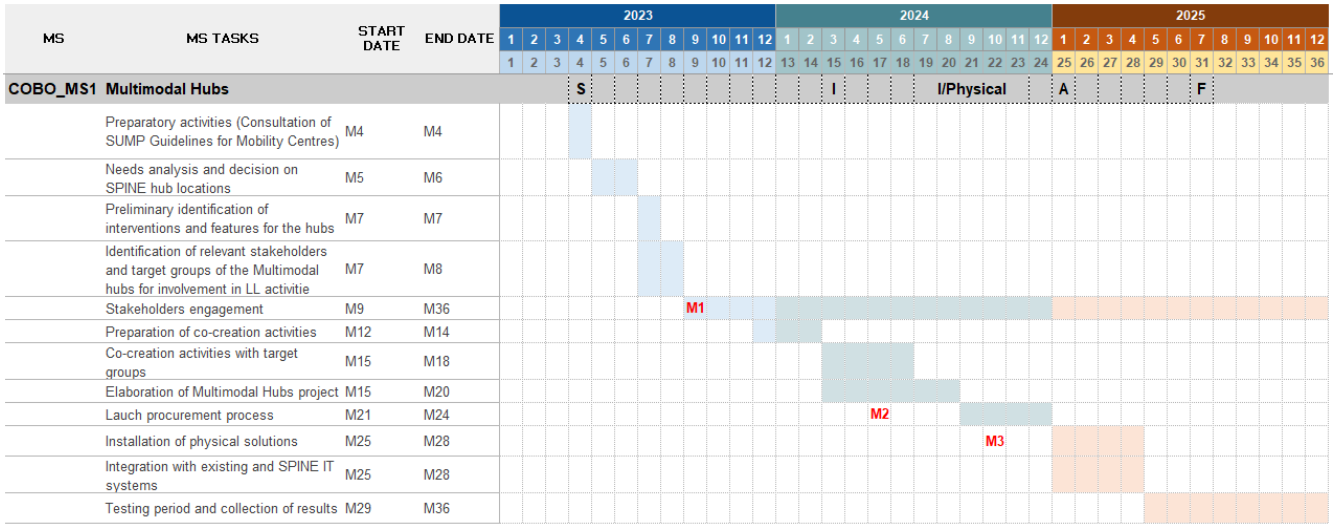

Figure 9: BOL_MS1 detailed timeline including constraints/assumptions and key implementation milestones

Milestones:

- M1: Start of stakeholder co-creation process (M9), relevant for the importance to involve local institutional stakeholders and mobility operators in the project from the very early stage;
- M2: Launch of procurement process (M17);
- M3: Launch of implementation process (M22), relevant for the progress monitoring of the action, refers to the physical implementation after the planning and co-design phase.

The work started by identifying 3 mobility hubs among the 9 located in the Bologna urban area: Mazzini to the east, Casteldebole to the west, Corticella to the north. Then, an analysis was conducted, based on the Design Guidelines for Mobility Hubs prepared by the Metropolitan City in agreement with RFI (Italian Railway Network). Such an analysis served to plan the interventions for increasing the offer of innovative and inclusive mobility services and, consequently, for improving the attractiveness and accessibility of the multimodal hubs, while improving the user experience and satisfaction.

Also, the main stakeholders were identified and invited to the first SPINE local kick-off in September 2023 (M1).

After the selection of the 3 SPINE hubs, target groups were defined based on SPINE GA, and co-creation activities were planned towards the end of 2023 and carried out March - May 2024.

4.2.4 Test plan and a monitoring plan for risk mitigation

The solution builds on an established plan which is outlined by the SUMP and has the necessary political support as well as clear guidelines for implementation. The process of implementation can also benefit from previous experiences gained during similar initiatives for the Mobility Hubs in Vergato and Castel San Pietro, in the Bologna Metropolitan city. In those similar initiatives, some preliminary feasibility studies were carried out in the past years. Moreover, the support of the Foundation IU Rusconi Ghigi allows to build the action on a solid experience in participatory processes and co-design of the interventions. However, there is always a risk that the necessary approvals and procurements will cause delays due to the need to follow long administrative procedures and obtain relevant permissions. Early identification of possible bottlenecks was carried out and will hopefully reduce the risk of important delays. Nevertheless, some minor delay is to be reported, for

example regarding M2 Launch of procurement process and M3 Launch of implementation process, even if with little foreseen impact on the general implementation of the solution. Main reason for the delay is that COBO gave a big importance to the participatory process for the co-design of interventions around the hub, therefore giving the focus groups and the labs the necessary time to elaborate ideas, with the final aim to have better and more impactful results for the end users.

4.2.5 Actual and future Business model

Potential future business models will be explored at the end of Task2.3, when the innovative elements introduced by SPINE will be in place, also with the support of the University of Antwerp. At the moment, one identified exploitable result is related to the co-creation methodology applied to the improvement of Multimodal Hubs, aiming to develop services based on the real needs of PT users. This methodology could be applied in the future to the improvement of other Multimodal Hubs in the city.

4.3 BOL_MS2 EV charging stations [MS4 - EV charging stations]

4.3.1 Description and experimentation area

EV charging stations are stationary infrastructures that provide electric energy for the recharging of electric vehicles, such as cars, bicycles and scooters. Currently, Bologna's EV charging stations within a 250-metre radius from the train stations are limited. At present, the Mazzini hub, one of the multimodal hubs considered in SPINE, has only one charging station, while at Casteldebole and Corticella hubs (the other hubs of SPINE) EV charging stations will be installed in the next few years. Within SPINE, the city will utilize the public parking spaces surrounding the stations to deploy charging stations for EVs. The selected SPINE hubs will consider the provision of improved accessibility for users with special mobility needs. They will be equipped with accessibility interventions, catering to individuals with unique mobility requirements. Special plugs accessible to wheelchair users will also be incorporated, fostering a user-friendly environment for all EV drivers.

This measure can be considered a sub-measure of BOL_MS1 Multimodal Hubs since it will be carried out at the selected hubs.

4.3.2 Actors and stakeholders

Implementer of BOL_MS2 is COBO, through a procurement process for installing 2 EV charging stations at each of the 3 selected hubs.

The procurement process is not funded by SPINE resources since it is a general one for the whole Bologna urban area. Within SPINE, COBO is including in the procurement process the special accessibility features for some of the stations, and will prioritize interventions by installing the needed accessible EV charging stations at the selected hubs.

Information on stations occupancy and charging capacity will potentially feed other SPINE local solutions, such as BOL_MS6 Smart City Platform and BOL_MS4 MaaS.

4.3.3 Detailed Implementation plan

MS	MS TASKS	START DATE	END DATE
COBO_MS2 EV Charging Stations			
	Tender procedure	M12	M15
	Installation of physical structures	M16	M21
	Integration with SPINE digital solutions	M22	M28

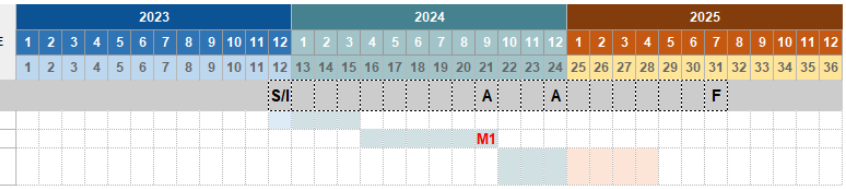

Figure 10: BOL_MS2 detailed timeline including constraints/assumptions and key implementation milestones

Milestones:

- M1: Accessible charging stations installed (M21) , relevant for the finalization and testing phase as one of the innovative elements at SPINE hubs.

The measure related to the new accessible EV charging stations to be installed at SPINE hubs was presented and shared during the co-creation activities with target groups in order to identify the most useful features for end-users. These features will be included in the technical requirements of the tender procedure which is currently under elaboration.

4.3.4 Test plan and a monitoring plan for risk mitigation

Differently from what was foreseen at the beginning of the project, the tender procedure did not start at month 12. The two main reasons for this are the following:(a) the tender procedure is a city-related process, not a specific SPINE process, so more time was needed to prepare the procedure; (b) since some of the EV charging stations of the tender will be installed at SPINE hubs, specific technical details had to be deeper investigated, as also the outcomes of the participatory co-design process were needed for the preparation of the general tender by the Mobility Department and for the alignment with the elaboration of the Multimodal Hubs project.

4.3.5 Actual and future Business model

No business model is foreseen for this solution at the moment. An exploitable result would be building on the SPINE experience to install other EV charging accessible stations in the city area.

4.4 BOL_MS3 Inclusive mobility services [MS5 - Inclusive mobility services]

4.4.1 Description and experimentation area

By providing transportation alternatives to all citizens, this measure endeavours to bridge the gaps in accessibility at the selected SPINE multimodal hubs and ensure that mobility is equally accessible and available to every user.

As already stated, this measure is linked with BOL_MS1 (Multimodal hubs) where a number of inclusive interventions will be deployed to make mobility services in the city more equal. Additionally, BOL_MS3 in Bologna is fed by the outcomes of the participatory co-design process carried out between March and May 2024. It will bring to the Multimodal Hubs specific elements which emerged from the consultation and the activities carried out with targeted end users groups (some examples: braille and audio communication for

visually-impaired users, visual instructions and efficient colour marking for hearing-impaired users included in digital signages and kiosks, information in different languages, etc.).

4.4.2 Actors and stakeholders

COBO will be the main implementer of this solution, supported by SRM and building on the results of the co-creation activities with the end-users. Stakeholders such as mobility operators and sharing companies are also involved to convey information related to their services in the informative equipment, which will be installed at the hubs for better inclusive mobility services. Also, some of the SPINE partners working on the Bologna solutions will be involved to align and integrate their tools with the new information systems to be installed (e.g. INSY for MaaS).

4.4.3 Detailed Implementation plan

MS	MS TASKS	START DATE	END DATE
COBO_MS3	Mobility Inclusive Services		
	Definition of framework for inclusive mobility services at the Multimodal Hubs	M15	M17
	Co-creation with target groups	M15	M17
	Design of the solutions in the framework of the Multimodal Hubs project	M15	M20
	Procurement procedure and selection of provider(s)	M21	M24
	Implementation of inclusive services	M25	M28

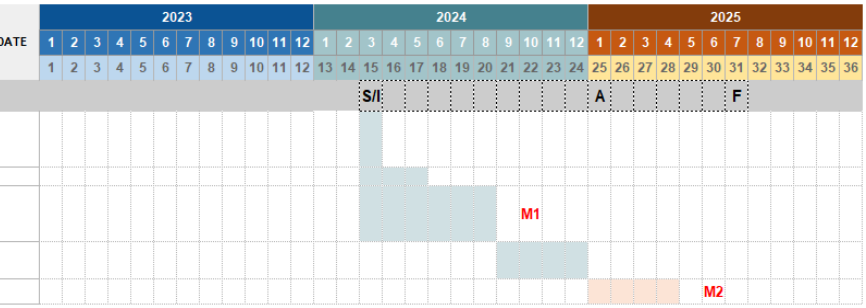

Figure 11: BOL_MS3 detailed timeline including constraints/assumptions and key implementation milestones

Milestones:

- M1: solutions planned (M22), relevant for starting of implementation phase of innovative inclusive elements at SPINE hubs;
- M2: solutions implemented and working (M30), relevant for the monitoring of the conclusion of the implementation phase.

Like BOL_MS2, also BOL_MS3 supports the measure BOL_MS1 Multimodal Hubs and its time plan is deeply linked with the implementation of Multimodal Hubs.

As an initial step, a framework for action in the context of SPINE was defined, building on the analysis of current features carried out at the 3 selected hubs, combined with the principles stated in the Guidelines for the design of Multimodal Hubs. The aim was to create a basket of possible interventions to be offered as ideas for co-creation workshops, in order not to create false expectations and to clarify the limits of SPINE resources. Then, co-creation activities with the identified target groups took place between March and May 2024 and the results are used to feed the Multimodal Hubs project.

4.4.4 Test plan and a monitoring plan for risk mitigation

A possible risk linked to BOL_MS3 is to develop solutions which are not in line with the real needs of citizens and commuters; to avoid this, the co-creation process was therefore aimed at favoring the implementation of solutions that are as close as possible to the identified needs of end users.

4.4.5 Actual and future Business model

No business model is foreseen at the moment. An exploitable result would be building on the SPINE experience to plan more inclusive mobility services in the city area.

4.5 BOL_MS4 MaaS [MS6: MaaS]

4.5.1 Description and experimentation area

Today in Bologna there are many public mobility services: buses, trains, bike-sharing, car-sharing, taxis, scooter-sharing, etc.. However, those services are not coordinated nor integrated in a common platform that would allow the user to plan a multimodal trip taking into account all of them. Each mobility system uses proprietary apps. Furthermore, with the exception of a few specific cases, there is no complete fare integration among the transport systems.

The MaaS solution aims at improving smart mobility in the metropolitan area. It will ensure alignment with municipal goals and priorities, fostering a potentially attractive platform for private investments and partnerships, which will lead to innovation and improvement of service quality.

The Bologna LL will experiment an "horizontal" MaaS solution in the metropolitan area, focusing on the intermodal travel planner and without including the fare integration and ticketing. This choice was taken to ensure the full implementation of the measure in the LL implementation period. Indeed, such a measure will allow to verify the MaaS attractiveness in the LL context, and to undertake the initial steps towards the full vertical integration of mobility operators. It will also allow to start understanding the potential impact of the MaaS on the mobility choices of citizens and city-users. Through the platform provided by Instant System, an integrated multimodal travel planner with as many operators as possible will be created, and the system will be tested on a wide basis.

This system will offer citizens and city users a new approach to Bologna's mobility system, with the potential of significantly increasing the use of sustainable transport options. Furthermore, it will allow the city to benefit from a deeper understanding of mobility data management and integration and make a first step towards an integrated MaaS service.

The test will be conducted on a predefined sample of citizens, which will be significant both in quantity (a minimum number of testers) and in representativeness of the city population (gender, age, activity/profession, etc.).

4.5.2 Actors and stakeholders

The main implementer of this solution is SRM, together with COBO and the SPINE technological partner Instant Systems. In addition, local mobility providers and local stakeholders are involved.

SRM (supported by COBO) identified the mobility operators in the metropolitan area and invited them to the working group. Also, SRM coordinates the continuous interaction between Instant System and the operators.

4.5.3 Detailed Implementation plan

MS	MS TASKS	START DATE	END DATE
COBO_MS4	MaaS		
	Working group activation	M9	M11
	Travel planner design	M11	M13
	Standard definition	M12	M14
	Integration of SPINE dataspace (Instant Systems)	M15	M15
	Instant Systems platform customization	M15	M20
	Beta testing validation 1	M21	M25
	Beta testing release	M21	M26
	Users' targeting	M22	M23
	Users' involvment	M23	M24
	Before-survey	M24	M25
	Beta testing validation 2	M26	M28
	Final release	M28	M28
	MaaS implementation running	M31	M36
	After-survey	M35	M36

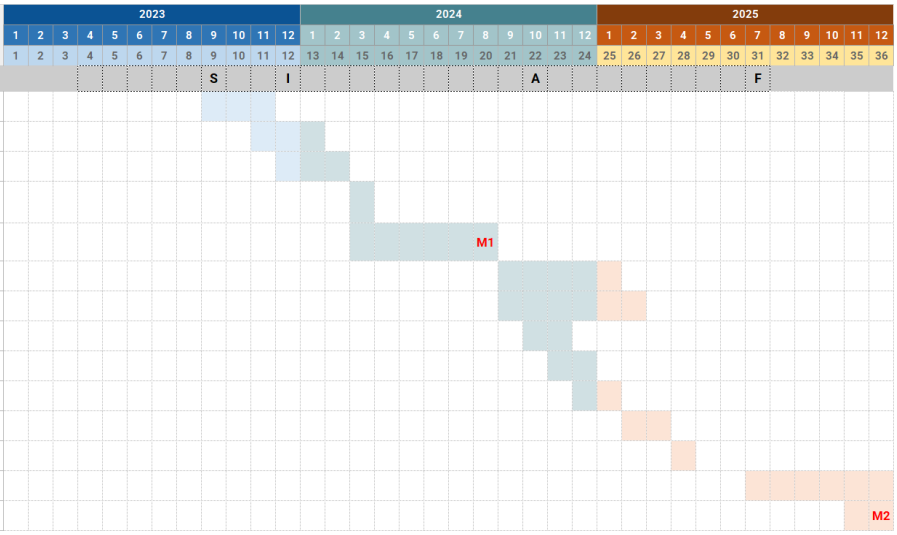

Figure 12: BOL_MS4 detailed timeline including constraints/assumptions and key implementation milestones

Milestones:

- M1: Customization of MaaS planner developed by Instant Systems (INSY) (Instant System platform customization, M20): relevant for the implementation of the solution, referring to the configuration of the MaaS platform for the Bologna LL with the available data;
- M2: After survey (M36): relevant for the importance of evaluating changes in participants' awareness and mobility habits, obtaining feedback on the system and for compiling KPIs.

The first step for implementing this solution was the working group activation, which began in M9. SRM (supported by COBO) identified all the mobility operators in the metropolitan area and invited them to the Working group. Then, in collaboration with the Working group and with the technological partner Instant System, SRM designed the MaaS platform features for the Bologna LL and identified the standard parameters for the interaction between the platform (developed by INSY) and the operators' real-time systems. As a result, Instant System is able integrate the SPINE dataspace for the MaaS in Bologna.

During their implementation, the various SPINE solutions in Bologna support each other: in this case, the "horizontal" MaaS platform could provide data to the information services located at the SPINE multimodal hubs.

4.5.4 Test plan and a monitoring plan for risk mitigation

The main potential risks identified for the implementation of the MaaS solution are represented by the lack of interest of operators in the MaaS platform or to join it, and the lack of interest of citizens in changing their mobility habits and the difficulty in involving them.

Key mitigation measures include: (i) a communications and awareness campaign aimed at both transport operators and citizens; (ii) inclusion of the MaaS among the topics for co-creation that are treated in the stakeholder engagement activities related to the Multimodal Hubs (exemplary questions: What would you like to see in a MaaS initiative? What are the obstacles to social acceptance? What kind of data does your organization collect and what are your concerns regarding the sharing of your data?); (iii) particular engagement

efforts aimed at involving Mobility Managers in the public and private sectors; (iv) testimonial users campaign featuring a known personality using the MaaS.

4.5.5 Actual and future Business model

Approach

In D.1.2, the lead cities' logic behind their basket of SPINE solutions has been investigated, detailing how these solutions could contribute towards the SPINE city's objectives, which partnerships and stakeholders should be involved, which actions are required and how this would affect their cost and revenues. It took the broader SPINE objectives as main value propositions. However, the solutions developed in cooperation with the SPINE technical partners are piloted and tested, raising the question whether they should be sustained after the project, and if so, which elements hinder or enable their further implementation within the lead city. In this regard, the technical partner involved in the living lab of Bologna, Instant System has been interviewed. This semi-structured interview focused on identifying the added value of their solution towards Bologna's SPINE objectives, Bologna's contextual factors impacting the applicability and suitability of the solution, the responsibilities of all stakeholders involved and how a positive business case could be established.

Business model

As detailed above, Instant System's solution for Bologna is developing a MaaS application. The value proposition of this solution is the integration of several mobility services, including public transport, bike sharing, car sharing and park-and-rides, into one platform, where the main feature is the journey planner. Real-time and historical information regarding the public transport services will firstly be included as it is the core mobility service in the MaaS-application. In an urban context such as Bologna, this includes several bus, tram or sharing operators, but it can also be extended to the regional public transport system, also including train operators.

The MaaS application is offered as a white-label solution, so that the public transport authority of Bologna or the city of Bologna can use their branding for the MaaS-application. It also provides an additional communication channel for users, to inform them about transport-related disruptions or events. The city or public transport authority pays for the development of the MaaS application, which can be both web-based and mobile application-based. The cost is related to the extent and complexity of the mobility services that must be integrated within the platform and the extensiveness of the transport area that must be covered. The local authority decides which mobility services should be integrated. If, next to a journey planner, also payment services need to be included for direct booking and payment through the application, the complexity increases and thus also the cost of the development. Therefore, the core feature of the white-label MaaS-solution is the journey planner and real-time information provision.

The main barrier is the harmonization of the data flows from the different mobility services. In this regard, the structure of the public transport data from Bologna is different compared to the structure of the public transport data from French cities, where Instant Systems is well-established, which adds to the complexity of the solution. Regarding the public transport data, the city is responsible for the data collection. For other mobility services, such as shared mobility, a connection with the API from the shared mobility provider must be established, which requires intense dialogue between them. Additionally, as the application is a white-label, the city or public transport authority can have their own account on the application stores, so that mobile users can download and install the application. However, this also holds risks when other applications from the city or PT authority are not well-perceived, so that citizens also regard the MaaS-application as unreliable.

The next step consists of discussing the evaluation criteria for this solution with all the lead cities, in order to understand if and how they can address some of the barriers and how they would evaluate these solutions before actually implementing and paying for them. In essence, for Instant System's solution to work, they need harmonized data from public transport services, connectors with private mobility operators and a reliable perception towards the citizens.

4.6 BOL_MS5 LEZ / CITY30 [MS7: LEZ (Low Emission Zone) - Green Area/City30]

4.6.1 Description and experimentation area

A low-emission zone (LEZ) is a designated geographic area where access to certain vehicles is restricted or discouraged as a deliberate measure to improve air quality within the LEZ's boundaries. Within SPINE, this solution will support the city's current policies promoting safer mobility, PT and active mobility options, which act through the introduction of (i) a low emissions zone (LEZ) more extended than the current one (based on the City of Bologna's SUMP initiative known as the Green Area), coupled with (ii) the City 30 km/h concept. The two main objectives are to reduce the number of polluting vehicles in the Green Areas of the city and to decrease average vehicle speed, making streets safer for active mobility options (cycling, walking) while also reducing fuel consumption and related GHG emissions.

SPINE support is twofold:

- on the one hand, SPINE is supporting communication and awareness raising activities around City30 policy;
- on the other hand, BOL_MS5 is deeply connected with BOL_MS9 PT prioritization, since PT priority is a sub-measure of the LEZ/City30 measure; in this context, the current city prioritization system will be analysed (see BOL_MS9) and some new priority scenario will be simulated and hopefully tested.

4.6.2 Actors and stakeholders

Main implementer of BOL_MS5 is COBO; as regards the communication campaign on the City30 policy, impactful synergies are being investigated with the past and current institutional campaigns supporting the city policy. From the digital impact assessment perspective, other actors involved in this measure are AIMSUN and CAMBIAMO, as explained in the introductory session of this chapter[3].

Synergies can also be found with BOL_MS9 PT prioritization and the technical partner YUNEX, as well as with SRM measures BOL_MS4 MaaS and BOL_MS7 Citizen App, as all measures support the change towards a more sustainable mobility and the increase in the use of PT and active mobility.

[3] See section 4.1

4.6.3 Detailed Implementation plan

MS	MS TASKS	START DATE	END DATE
BOL_MS5	LEZ (Low Emission Zone) - Green Area/City30		
	Setting up vehicle flow monitoring: cameras installation and software implementation	M3	M17
	Communication / awareness raising campaign on City30	M12	M27
	Data collection through cameras	M13	M24
	Integration of data in SPINE tools (SCP)	M13	M27
	Analysis of collected data	M25	M26
	Development of environmental charging scheme based on the collected data and vehicle flow patterns	M27	M27
	Implementation and monitoring of the charging scheme	M27	M36
	Analysis of results of charging scheme: trends and changes in composition of vehicle flows, emissions, revenues generated	M36	M36

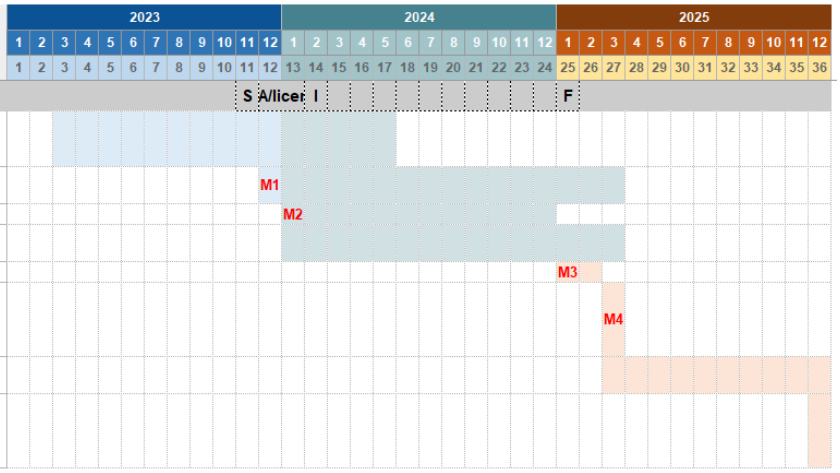

Figure 13: BOL_MS5 detailed timeline including constraints/assumptions and key implementation milestones

Milestones:

- M1: Launch of awareness and communication campaign (M12), relevant to give support through SPINE to the city awareness campaigns around City 30 policy;
- M2: Start of data collection (M13);
- M3: baseline for vehicle flows and emissions in 2024 established, derived from data collected during the year (M24);
- M4: Launch of charging scheme and awareness and communications actions for the charging scheme (M27); this milestone will be reformulated and adapted to the new layout of BOL_MS5, described in section 4.6.4.

This measure builds on the introduction of two new city mobility policies: a new much more extended LEZ compared to the existing one, and the new City30 policy to reduce the speed limit in the whole urban area. 30 cameras were installed at the main entrance corridors in order to monitor the type of vehicles accessing the urban area; data was collected throughout the year 2023 (not with SPINE resources) in order to build a new congestion charging scheme starting from 2024 (supported by SPINE through AIMSUN simulation model).

In parallel, communication and awareness raising activities are being planned on the City30 policy, with the potential support of FIU which is already working on City30 communication on a city level.

4.6.4 Test plan and a monitoring plan for risk mitigation

Bologna's first priority for WP3 was to develop a simulation model as a tool to support the definition of LEZ policies focused but not limited to tariffs, vehicles affected, number and position of LEZ cameras, impact on emission targets. In the initial idea, data from LEZ cameras provided by the city should have allowed AIMSUN to transform information on vehicles accessing the city in terms of environmental label into simulation models able to assess the impact of different possible charging schemes. A second priority was also selected by the city in connection with the same BOL_MS5 measure, specifically the development of a simulation model for assessing PT planning and its prioritization.

After the analysis conducted by AIMSUN on data sources and models available for the city of Bologna, the most feasible digital impact assessment model was found to be Bologna's priority no.2, regarding PT planning

and prioritization, closely connecting BOL_MS5 to BOL_MS9 PT prioritization [MS13: Traffic Management / PT prioritization services]. Nevertheless, the assessment is still well connected with BOL_MS5 because the set of corridors of interest for the models have been selected to be aligned with the implementation of the actual City 30 policy.

4.6.5 Actual and future Business model

No business plan is foreseen at this stage of the project for this solution.

4.7 BOL_MS6 Smart City Platform [MS8: Smart City Platform]

4.7.1 Description and experimentation area

Within SPINE, the Smart City Platform (SCP) aims to assist the city authorities and operators to efficiently manage their operations and assets, and to monitor the SPINE-related mobility measures through targeted KPIs, aiming at an improved planning of mobility services. Quantitative KPIs indicatively include indicators related to modal split, traffic conditions, user satisfaction and environmental aspects. The SCP works as a Software as a Service (SaaS) application that can be integrated with a variety of data sources and pull&push information using APIs and data ingestion procedures. A set of different functionalities and dashboards are foreseen including Goal view, Modules view, KPIs & Analytics view.

4.7.2 Actors and stakeholders

COBO, SRM, and the technological partner IBI are the main implementers of the measure in the Bologna LL. Other involved actors are all mobility operators involved from the early stage of the project who are asked to collaborate in sharing their data to be embedded in the SCP.

4.7.3 Detailed Implementation plan

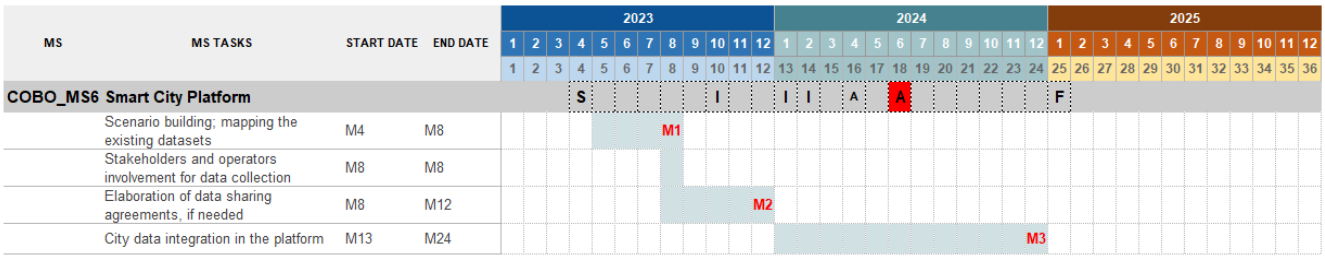

Figure 14: BOL_MS6 detailed timeline including constraints/assumptions and key implementation milestones

Milestones:

- M1: Datasets to be integrated in the SCP identified (M8), relevant as a basis for future work;
- M2: Data sharing agreements signed - if needed (M12);
- M3: SCP running (M24), relevant for the progress monitoring of the measure.

During the first months of the project, all existing datasets were mapped by COBO and SRM with the support of IBI; then, data samples were provided to IBI to test the quality of data, which was approved. IBI is now elaborating a first demo version of the Bologna SCP.

4.7.4 Test plan and a monitoring plan for risk mitigation

Data access and data quality had been initially identified as main potential risks; nevertheless, from the analysis conducted by IBI on data samples provided by the city, this resulted to be a minor risk.

4.7.5 Actual and future Business model

Approach

In D.1.2, the lead cities' logic behind their basket of SPINE solutions has been investigated, detailing how these solutions could contribute towards the SPINE city's objectives, which partnerships and stakeholders should be involved, which actions are required and how this would affect their cost and revenues. It took the broader SPINE objectives as main value propositions. However, the solutions developed in cooperation with the SPINE technical partners are piloted and tested, raising the question whether they should be sustained after the project, and if so, which elements hinder or enable their further implementation within the lead city. In this regard, the technical partner involved in the living lab of Bologna, IBI, was interviewed. This semi-structured interview focused on identifying the added value of their solution towards Bologna's SPINE objectives, Bologna's contextual factors impacting the applicability and suitability of the solution, the responsibilities of all stakeholders involved and how a positive business case could be established.

Business model

As detailed above, IBI's solution for Bologna is the development of the Smart City Platform. The value proposition is multifaceted; it allows to better monitor KPIs across various domains such as traffic management, energy management or public transport management. Currently, there is a lack of understanding of the current situation of the traffic system, so it is difficult to assess where improvements can be made to the network.

Analyzing the current situation requires data input from various sources. This is also the main barrier for this solution to be easily implemented and be further developed beyond the project. When the owners of the data, who could be various stakeholders such as public transport operators, road infrastructure authorities or traffic operators, are not able to deliver raw data to IBI, the processing of the data requires time and resources which affects the costs of this system for the local authority. Furthermore, the interest of the data owners could be different than the interest of the local authority, which could hinder an exchange of data between IBI and the data owners. It is therefore necessary that the local authority has a good understanding on which kind of data is available; who is the owner of these data; and how they could provide the data as a raw source so that IBI can more easily process and integrate it in their management system. Based on what kind of KPIs the city wants to monitor, IBI will require certain data types which the city then must collect. After the integration of the data sources into the Smart City Platform, the second step consists of analysing the data and providing information on the various KPIs in the various domains.

IBI also offers, as part of their product offer, hardware that collects data which feeds directly into the management system. Additionally, they provide consulting services on how certain data can be collected or which kind of improvements can be made (to improve certain KPIs).

For Bologna to evaluate whether this solution can or has to be sustained after the project, it is essential that they closely monitor whether their understanding on the KPIs (and related barriers) improves when the Smart City Platform is implemented. Furthermore, it must be evaluated whether the current connections with data owners can be used within the smart city interface, as this will significantly affect the potential costs.

The next step consists of discussing the evaluation criteria for this solution with all the lead cities, in order to understand if and how they can address some of the problems IBI raises and how they would evaluate these solutions before actually implementing and paying for them. In essence, for IBI's solutions to work, the city needs to establish an effective data management system that can directly feed into the Smart City Platform, so that IBI can perform big data analytics to monitor the current situation and identify flaws in the network. If the data is not of sufficient quality or is unavailable, IBI provides as part of their product offerings hardware and consulting services that can support the data collection.

4.8 BOL_MS7 Citizen Mobility App / Micro-incentives programme [MS9: Citizen Mobility App / Micro-incentives programme]

4.8.1 Description and experimentation area

The Citizen Mobility App is a mobile application developed by the technology partner MOBY. The app empowers citizens to participate in the SPINE project, engage with the co-creation of solutions and "generate" the impact of the proposed measures. It is designed to act as an integrator of existing services and solutions developed in SPINE.

For the Micro-incentives programme developed in Bologna, only some of the Citizen Mobility App functionalities will be used. The Micro-Incentives Campaign will be directed to a selected range of users, whose involvement will be done and measured through the Citizen Mobility App and their degree of satisfaction will be assessed using ad-hoc questionnaires. The effective change of their travel behavior will be evaluated as well, through a questionnaire and/or using the Citizen Mobility App features.

The target users identified are the employees of some of the companies located in the Bologna area. The testing will engage only those companies which have in their internal organization the Mobility Manager (mandatory for companies with more than 100 employees, ref. Italian Law 77/2020). The app, which works with passive tracking, will be settled to track the home-to-work (and vice versa) commute by any means of transport.

4.8.2 Actors and stakeholders

The main measure implementer is SRM, in collaboration with COBO and local stakeholders and with the support of the SPINE technological partners MOBY.

SRM (supported by COBO) identified the target groups for the Micro-Incentives Campaign (the initial basket of potential target groups included scholars/students, employees, citizens, etc.) and the stakeholders to be involved (the initial basket included School authorities, Mobility managers, local public authorities, etc.). The SPINE partner MOBY is in charge of the customization and testing of the existing Citizen Mobility App for the Micro-Incentives Campaign in Bologna. COBO supports SRM in the activities and is an essential actor in reaching out to companies that will be involved in the testing. Employees and Mobility Manager of the companies involved as target groups are key actors in the implementation of this solution.

4.8.3 Detailed Implementation plan

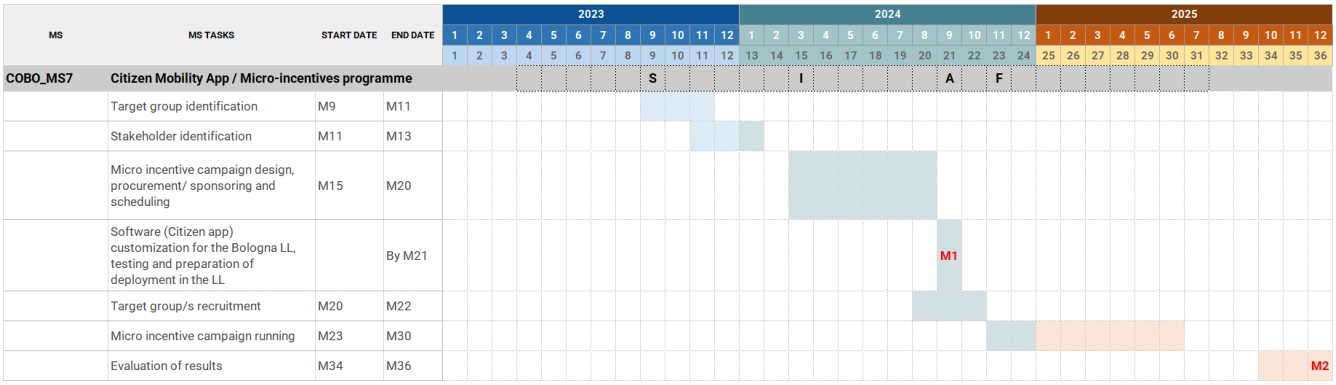

Figure 15: BOL_MS7 detailed timeline including constraints/assumptions and key implementation milestones

Milestones:

- M1: Software (Citizen App) customization for the Bologna LL, testing and preparation of deployment in the LL (M21): relevant for the consequent work of implementing the Micro-incentives campaign;
- M2: Evaluation of results (M36): relevant for the analysis of the impact of the measure.

The work started in M9 when SRM (supported by COBO) identified the potential target groups and then the stakeholders to be involved. The final identification of the target group to be involved, i.e. employees of some of the companies located in the Bologna area which have in their internal organization the Mobility Manager, was done at the beginning of year 2024. After this, SRM (with MOBY and COBO) started working on the Micro-Incentives Campaign design, procurement / sponsoring and scheduling. This phase is planned to end at M20.

4.8.4 Test plan and a monitoring plan for risk mitigation

The main potential risk identified for the BOL_MS7 is the potential delay in getting onboard all the Mobility Managers, which are the fundamental actors to reach the employees of the companies.

To avoid this risk, SRM will promptly provide all the Micro-Incentives Campaign App details from MOBY to the Mobility Managers, counting also on the essential COBO's support for reaching out to the companies.

4.8.5 Actual and future Business model

Approach

In D.1.2, the lead cities' logic behind their basket of SPINE solutions has been investigated, detailing how these solutions could contribute towards the SPINE city's objectives, which partnerships and stakeholders should be involved, which actions are required and how this would affect their cost and revenues. It took the broader SPINE objectives as main value propositions. However, the solutions developed in cooperation with the SPINE technical partners are piloted and tested, raising the question whether they should be sustained after the project, and if so, which elements hinder or enable their further implementation within the lead city. In this regard, the technical partner involved in the living lab of Bologna, MOBY, was interviewed. This semi-structured interview focused on identifying the added value of their solution towards Bologna's SPINE objectives, Bologna's contextual factors impacting the applicability and suitability of the solution, the responsibilities of all stakeholders involved and how a positive business case could be established.

Business model

As detailed above, MOBY's solution for Bologna is customizing the Citizen Mobility App. The value proposition of this solution is multifaceted; it offers a central bidirectional communication possibility towards citizens, which enables receiving feedback from citizens on certain initiatives that the city is undertaken. It increases citizen engagement and allows to co-create initiatives together with citizens. This would enable the city to nudge citizens' behavior and increase the city's ability to take citizens' considerations into account when developing and planning new sustainable initiatives.

This Citizen Mobility App is provided as a SaaS model, which provides a standardized platform that can be adapted. It is a white-label solution where the city of Bologna has the possibility to integrate or add new components (which will impact on the fee that has to be paid). One of the additional features being tested within SPINE is the use of Micro-incentives to nudge citizens' travel behavior. This could contribute to higher usage of public transport and other sustainable travel modes. Future development could integrate other external tools, such as journey planners or MaaS applications, into the Citizen Mobility App. This would require extensive dialogue between the city, MOBY and the external partner to enable this integration, which also impacts the cost of the Citizen Mobility App platform. For MOBY to sustain the platform and scale its solution to other cities, it is essential standardizing its platform and exploring additional revenue streams such as B2B-marketing possibilities.

One of the main barriers is that the platform also relies on the input and engagement from citizens. When they are not active on the platform, it becomes an additional unidirectional communication channel from the city towards its citizens, which is most probably already present in the city. However, this also requires intensive moderation of the bidirectional communication, which is the responsibility of the city. If the city does not allocate enough resources to carry out the moderation, there are risks related to opening a direct feedback channel for citizens. To mitigate certain risks, MOBY integrated tools in the platform so that certain answers cannot be given by citizens or spam is filtered.

The next step consists of discussing the evaluation criteria for this solution with all the lead cities, in order to understand if and how they can address some of the barriers and how they would evaluate this solution before actually implementing and paying for them. In essence, for MOBY's solution to work, they need active commitment and moderation from the city, its citizens and integration possibilities with other external partners that can improve usefulness of the citizen application.

4.9 BOL_MS8 Logistic solutions [MS10 Logistic solutions]

4.9.1 Description and experimentation area

As part of SPINE, this measure focuses on improving freight operations and their efficient transportation in urban environments. In SPINE, this measure will be implemented in Bologna with the aim to support the reduction of CO_2 emissions and the presence of polluting vehicles within the city centre adopting sustainable last-mile mobility services in the urban logistic chain. For this purpose, the city will advance the activities implemented as part of the Horizon Europe URBANE project and undertake an analysis to explore innovative solutions for the optimization of PT in low congestion peak hours, or other kind of possible improvement of Nearby Delivery Areas (NDA for short), outlined in the Bologna SULP.

4.9.2 Actors and stakeholders

The main implementer of this measure is COBO, building on the experience of the URBANE project, which tested three NDAs for the transshipment of goods from traditional vehicles to EV for sustainable and collaborative last mile deliveries in the historic centre of the city.

This SPINE measure will obviously be supported by the URBANE partners collaborating with COBO in the testing of the local pilot action (ITL - Foundation for Transports and Logistics of the Emilia-Romagna Region, together with the two logistic companies participating to the testing and the company that developed the software managing the logistic chain).

4.9.3 Detailed Implementation plan

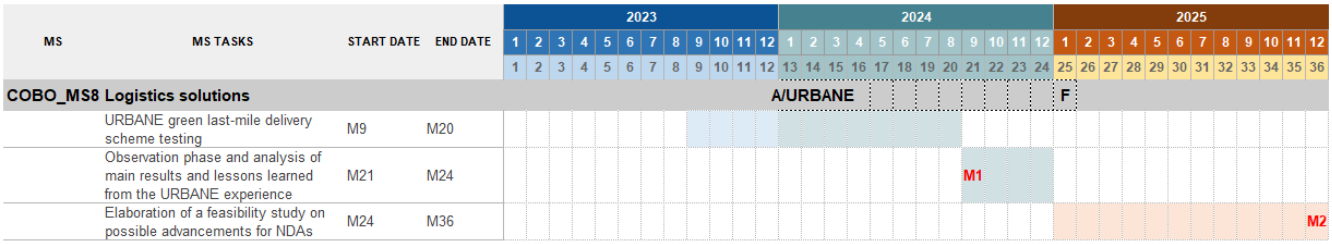

Figure 16: BOL_MS8 detailed timeline including constraints/assumptions and key implementation milestones

Milestones:

- M1: Testing of URBANE last-mile delivery scheme completed (M21); this step in URBANE project will build the base for the analysis to be conducted in SPINE;
- M2: Feasibility analysis (M36), knowledge driven from the URBANE experience to the SPINE context for possible application of similar green last-mile logistic models.

In the context of the Horizon Europe URBANE project, coordinated by Inlecom and where COBO is a beneficiary, an innovative sustainable and collaborative scheme for last mile logistics is being tested. The pilot action started in February 2024 (SPINE M14) and is based on the implementation of 3 NDAs at three identified places on the ring road around the city centre, as foreseen in the SULP. The testing is currently running until the end of September 2024.

4.9.4 Test plan and a monitoring plan for risk mitigation

The main risk is represented by different barriers which have already been identified in the preparatory phase of the activity, such as parcels security, responsibility sharing issues, etc.

4.9.5 Actual and future Business model

Possible development of the innovative collaborative and sustainable logistic scheme tested will be elaborated in the next months under the umbrella of the URBANE project. No business model in the framework of SPINE has been explored for this measure, yet.

4.10 BOL_MS9 Traffic Management / PT prioritization services [MS13: Traffic Management / PT prioritization services]

4.10.1 Description and experimentation area

The primary objective of this measure is to enhance PT reliability, reduce travel times, and optimize green waves through an analysis of the current PT prioritization system and the elaboration of suggestions for possible improvements, also based on the synergy with the support to City30 policy and the simulation models elaborated by AIMSUN (as described in section 4.6).

4.10.2 Actors and stakeholders

The implementer of this measure is COBO, together with SPINE tech partner YUNEX, that will provide the analysis of the current system along with potential improvement suggestions. Data for the analysis are provided by SWARCO, provider of the Municipality of Bologna and owner of the system managing traffic lights regulation.

4.10.3 Detailed Implementation plan

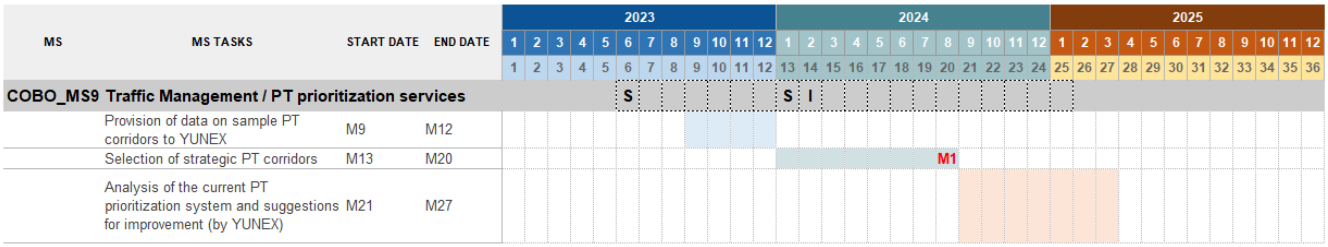

Figure 17: BOL_MS9 detailed timeline including constraints/assumptions and key implementation milestones

Milestones:

- M1 Strategic PT corridors selected (M20), selection of the most significant city areas from the point of view of PT connections as a basis for the analysis to be carried out within this measure.

A first sample of data from SWARCO's OMNIA system was provided to YUNEX at the end of 2023. Datasets are currently being analysed in terms of information content and compatibility with WP3 digital impact assessment models by AIMSUN. A selection of strategic PT corridors to support a better management of City30 policy was carried out by COBO and will be further refined/scaled up at the end of the verification process performed by technical partners.

4.10.4 Test plan and a monitoring plan for risk mitigation

Data access and data quality were initially identified as main potential risks; nevertheless, from the first analysis conducted by YUNEX on data samples provided by the city, this resulted to be a minor risk.

4.10.5 Actual and future Business model

Approach

In D.1.2, the lead cities' logic behind their basket of SPINE solutions has been investigated, detailing how these solutions could contribute towards the SPINE city's objectives, which partnerships and stakeholders should be involved, which actions are required and how this would affect their cost and revenues. It took the broader SPINE objectives as main value propositions. However, the solutions developed in cooperation with the SPINE technical partners are piloted and tested, raising the question whether they should be sustained after the project, and if so, which elements hinder or enable their further implementation within the lead city. In this regard, the technical partner involved in the living lab of Bologna, YUNEX, was interviewed. This semi-structured interview focused on identifying the added value of their solution towards Bologna's SPINE objectives, Bologna's contextual factors impacting the applicability and suitability of the solution, the responsibilities of all stakeholders involved and how a positive business case could be established.

Business model

As detailed above, YUNEX's solutions for Bologna include the smart traffic management system for public transport and public transport prioritization. The value proposition of this solution is to better monitor and improve the public transport flow throughout the network. Currently, there is a lack of understanding of the current situation of the public transport flow, so it is difficult to assess where improvements can be made to the network.

Analysing the current situation requires data input from various sources. This is also the main barrier for this solution to be easily implemented and be further developed beyond the project. When the owners of the data, who could be various stakeholders such as public transport operators, road infrastructure authorities or traffic operators, are not able to deliver raw data to YUNEX, the processing of the data requires time and resources which affects the costs of this system for the local authority. Furthermore, the interest of the data owners could be different than the interest of the local authority, which could hinder an exchange of data between YUNEX and the data owners. It is therefore necessary that the local authority has a good understanding which kind of data is available; who is the owner of these data; and how they could provide the data as a raw source so that YUNEX can more easily process and integrate it in their management system. Only after the raw data is delivered, data standards can be established so that there is continuous monitoring of the public transport flow in the network.

As stated, part one of the solution is the monitoring and analysis of the current situation. Based on this analysis, certain improvements can be suggested. It enables data-driven decision making. One of the interventions that could help improve the flow at certain intersections is the green light prioritization for public transport vehicles. This is one of the features YUNEX is testing within SPINE. Additionally, their generic approach allows them to suggest other features and solutions from their portfolio to optimize the network. YUNEX also offers, as part of their product offer, hardware that collects data which feeds directly into the management system. This allows them to better assess the current situation and adequately suggest solutions that can improve this situation. If cities are able to implement a data management system that collects the raw data from various stakeholders, this reduces the costs from YUNEX solutions and improves the potential benefit from solutions such as green light prioritization. Bologna already has a PT prioritization system in use, which indicates they already have connections with several data sources. This will be further explored by YUNEX the possibility of connection with these data sources, which could optimize efforts and reduce related costs.

For Bologna to evaluate whether this solution can or has to be sustained after the project, it is essential that they closely monitor whether their current PT prioritization system is functioning based on the output from

YUNEXPT traffic management system, whether implementation of green light prioritization effectively improves efficiency of the network and whether their understanding of the current barriers in the network improves when the PT traffic management system is implemented. Furthermore, it must be evaluated whether the current connections with traffic operators can be used within the public transport management system interface, as this will significantly affect the potential costs.

The next step consists of discussing the evaluation criteria for this solution with all the lead cities, in order to understand if and how they can address some of the problems YUNEX raises and how they would evaluate these solutions before actually implementing and paying for them. In essence, for YUNEX's solutions to work, they need data in raw format from various traffic operators, so they would be able to analyse the current situation and identify flaws in the network. If the data is not of sufficient quality or is unavailable, YUNEX provides the hardware that can collect the required data as part of their service offerings.

5 Conclusions

This deliverable is the first version of the Bologna LL and Implementation report. It focuses on the Bologna Living Lab developed through SPINE Task 2.3, detailing the related actions and their implementation. All the LL actions are developed following the SPINE methodology, and their main steps are defined through the SIAF tracking method, the latter being particularly tailored for the coordination of SPINE WP2-WP4. The deliverable details the establishment, operation, and progress of the Living Lab (LL) in Bologna in the period March 2023 - June 2024 (M3-M18).

Indeed, this deliverable is an effective tool for getting consolidated information about the LL in the Lead city of Bologna as it describes the city context, the LL stakeholders and operational details at the basis of the SPINE actions. It includes requirements and use cases, a detailed implementation plan including also the operational zones and parameters for all the nine SPINE measures applied in Bologna, and also presents the related risks and the related mitigation plans. It also provides the current full list of Bologna KPIs, with baseline and target values and foreseen monitoring method, in alignment with activities conducted in WP1. For some of the measures (i.e. BOL_MS4 MaaS, BOL_MS6 Smart City Platform, BOL_MS7 Citizen Mobility App / Micro-incentives programme, BOL_MS9 Traffic Management / PT prioritization services) it also provides the Business model as developed so far by the partner UA in collaboration with the IT technology providers. The continuous dialogue and collaboration between SRM and COBO, alongside their working teams - and those of SPINE technological partners and WP leaders - is crucial for the positive development of the Bologna Living Lab. This cooperative effort has enabled the LL to progress effectively, overcoming various barriers and challenges along the way, and is duly highlighted in the deliverable, as this document also describes the decision making process at the basis of Bologna LL, presents city mobility stakeholders together with the methodology for their involvement in project actions, as well as the engagement of SPINE target groups in co-creation activities, and the role of SPINE technology partners developing digital tools in the LL.

In the LL evolutionary path, D2.5 sets the outlines for a complete catalogue about the setup, operation and progress of LL towards its full deployment, which will be described in the final version of this deliverable - i.e. D2.6 Bologna LL and implementation Final Version - at M36. Indeed, D2.6 will consolidate the results of the implementation of the LL along with user acceptance feedback and lessons learnt, describing the demonstration activities and including measurements on both the physical and digital impact assessment, and impact indicators during and after the successful implementation of the LL.

6 References

[1] Bologna Sustainable Urban Mobility Plan, SUMP, 2019, https://pumsbologna.it/

[2] SPINE GA No. 101096664

[3] SPINE D2.1 Living Labs Report & Legacy Version 1

[4] SPINE D7.1 SPINE Quality Handbook and Risks Registry

7 Annex: Bologna LL KPIs

Indicator ID	Indicator name	Indicator Definition	Pilot City-Measure ID	Unit	Baseline	Target	Monitoring method
IND1	*Average modal split of public transport*	*Percentage of trips using PT during a day (weekday, week-end day). For an area the model split of both the trips of the residents and the in- and outgoing people are analysed.*	BOL_MS1, BOL_MS2, BOL_MS3, BOL_MS4, BOL_MS5, BOL_MS7, BOL_MS9	% of trips with PT (bus+trolley+train)	21% (Baseline year: 2016)	27,30%	Questionnaire surveys/travel diaries, data collected from MaaS and Citizen app
IND2	*Citizens satisfaction with public transport services*	*User average reported satisfaction with the overall quality of the public transport system and/or the quality of a specific service. It measures the experience of the user/provider, against its expectations.*	BOL_MS1, BOL_MS2, BOL_MS3, BOL_MS4, BOL_MS5, BOL_MS7, BOL_MS9	% of passengers being satisfied	83% of residents in the Metropolitan City of Bologna (Baseline year: 2021-22)	Due to the high baseline values, the target to increase user satisfaction by 25% is challenging	Specific surveys (Likert scale questions)
IND3	*User satisfaction with the SPINE solutions*	*User average reported satisfaction with the overall quality of the SPINE solutions. It measures the experience of the user/provider, against its expectations.*	BOL_MS1BBOL_MS2, BOL_MS3, BOL_MS4, BOL_MS5, BOL_MS7, BOL_MS8, BOL_MS9	Weighted average of user satisfaction with a qualitative score (1-5) of the perception of quality	There is no baseline.	Weighted average 3.5 / 5 (5=very satisfied, 1=very dissatisfied)	Specific surveys during and after the implementation of SPINE solutions (Likert scale questions)

Indicator ID	Indicator name	Indicator Definition	Pilot City-Measure ID	Unit	Baseline	Target	Monitoring method
IND5	*Number of cars entering the city centre*	*Number of cars entering the Low Emission Zone (LEZ) of the city*	BOL_MS1, BOL_MS3, BOL_MS4, BOL_MS5, BOL_MS7, BOL_MS9	Vechicles/year	12.072.138 vehicles / year (counted using 19 electronic gates in 2022)	10.800.000 vehicles / year	Traffic counts at specific locations
IND8	*Air pollution*	*Amount of air pollutants (CO, Nox, PM) at 3 locations in the city*	BOL_MS1, BOL_MS2, BOL_MS3, BOL_MS4, BOL_MS5, BOL_MS7, BOL_MS8, BOL_MS9	mg/m3 for CO; µg/m3 for N02, PM2.5, PM10	NO2: - San Felice: 39 µg/m3 - Giardini Margherita: 18 µg/m3 - Via Chiarini: 16 µg/m3 PM10: - San Felice: 27 µg/m3 - Giardini Margherita: 23 µg/m3 - Via Chiarini: 25 µg/m3 PM2.5: - San Felice: 17 µg/m3 - Giardini Margherita: 14 µg/m3 CO: - San Felice: 0.6 µg/m3 (Baseline year 2022)	City's target is for the specific areas to not exceed following values: NO2 40 µg/m3; PM10 40 µg/m3; PM2.5 25 µg/m3; CO 10 µg/m3	Data collected by city stationary monitoring at 3 key locations (San Felice, Giardini Margherita, via Chiarini) for SUMP monitoring
IND10	*PT passengers by age*	*Average age of the PT users*	BOL_MS3, BOL_MS7	Age	43,7 years old (Baseline year: 2016)	The city cannot safely predict a change in the baseline	Surveys

Indicator ID	Indicator name	Indicator Definition	Pilot City-Measure ID	Unit	Baseline	Target	Monitoring method
IND11	*PT passengers by gender*	*Gender classification of PT users*	BOL_MS3, BOL_MS4, BOL_MS7	%male, %female, % of other gender identities	61% female 39% male (Baseline year: 2016)	The city cannot safely predict a change in the baseline	Surveys
IND18	*Roads with restricted speed zone*	*Length of the restricted speed roads in the LEZ area*	BOL_MS5	Km	218 km (Baseline year: 2022)	530 km	Kms of roads with speed limit restrictions
IND19	*Traffic accidents*	*Number of traffic accidents*	BOL_MS5	Traffic accidents	2120 traffic accidents (Baseline year: 2022)	1060	Number of registered traffic accidents in the area of reference
IND22	*Reliability of PT*	*Percentage of Buses that Arrived/Departed On Time (punctuality rate)*	BOL_MS9	% of buses on time	76,7% (baseline year 2021) 73% (baseline year 2019)	0,75	GPS data, GPS tracking systems
IND24	*Number of bike-sharing users*	*Average number of bike-sharing users in the city per month*	BOL_MS1 BOL_MS4 BOL_MS5	Monthly average users	30.000 monthly users on average (Baseline year 2022)	32.000 monthly users on average	Data collected from the providers of the Bike-sharing systems
IND25a	*Number of trips conducted by bike-sharing*	*Average number of bike-sharing trips in the city per month*	BOL_MS1 BOL_MS4 BOL_MS5	Trips/month	120.000 trips per month on average (Baseline year=2022)	130.000 trips per month on average	Data collected from the providers of the Bike-sharing systems
IND45	*Number of multimodal hubs improved*	*Number of multimodal hubs improved through SPINE project*	BOL_MS1	Number of hubs	0	3	Number of hubs improved thanks to the support of the SPINE project

Indicator ID	Indicator name	Indicator Definition	Pilot City-Measure ID	Unit	Baseline	Target	Monitoring method
IND49	*Perceived quality of the multimodal hub*	*Perceived quality and suitability of infrastructure and facilities within the hub, including the design of platforms, waiting areas, ticketing facilities, and accessibility for individuals with disabilities.*	BOL_MS1	% of satisfaction with mobility hubs	There is no baseline value right now. The city will conduct a small scale survey to get the baseline values during WP2	The target value will be specified by the city	Data collected through small scale surveys after the interventions (Likert-scale questions)
IND52	*EV charging stations*	*Number of EV charging stations to be installed through SPINE*	BOL_MS2	EV charging stations	0	9 EV stations	Number of installed EV charging stations at SPINE hubs
IND53	*Coverage of Low emission zones*	*Coverage area of the LEZ in the city*	BOL_MS5	Km2	4 km2	55 km2	Coverage (km2) of low and zero emission zones
IND54	*Installation of digital signages/interactive screens etc.*	*Number of digital signages that will be installed in the city*	BOL_MS1	Digital signages/screens	No baseline since this is a SPINE measure	10 digital signages	Number of installed digital / interactive screens
IND56	*Mobility integration in the multimodal app*	*Number of transport modes/mobility services integrated within the MaaS app*	BOL_MS4	Mobility services	No baseline since this is a SPINE measure	3 mobility services	Count of mobility services included in the app provided by INSY
IND57	*MaaS/multimodal journey planner app trips*	*Number of trips booked/routes requested through the MaaS app*	BOL_MS4	Trips	No baseline since this is a SPINE measure	500	Data from the MaaS platform (INSY)

Indicator ID	Indicator name	Indicator Definition	Pilot City-Measure ID	Unit	Baseline	Target	Monitoring method
IND58	*MaaS/multimodal journey planner app registered users*	*Number of user registrations or accounts created on the MaaS platform*	BOL_MS4	users / accounts	No baseline since this is a SPINE measure	100	Data from the MaaS platform (INSY)
IND59	*Citizen app registered users*	*Number of user registrations or accounts created on the citizen app*	BOL_MS7	Users	No baseline since this is a SPINE measure	1000 users	Data from the citizen app (MOBY)